RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

BRIDGES - BUILDINGS - CONTRACTING - SIGNALING - TRACK

New Series, Vol. IX
Old Series, Vol. XXVIII | *Chicago* | DECEMBER, 1913 | *New York* | No. 12

THE ONLY JOURNAL DEVOTED EXCLUSIVELY TO RAILWAY ENGINEERING AND TRACK

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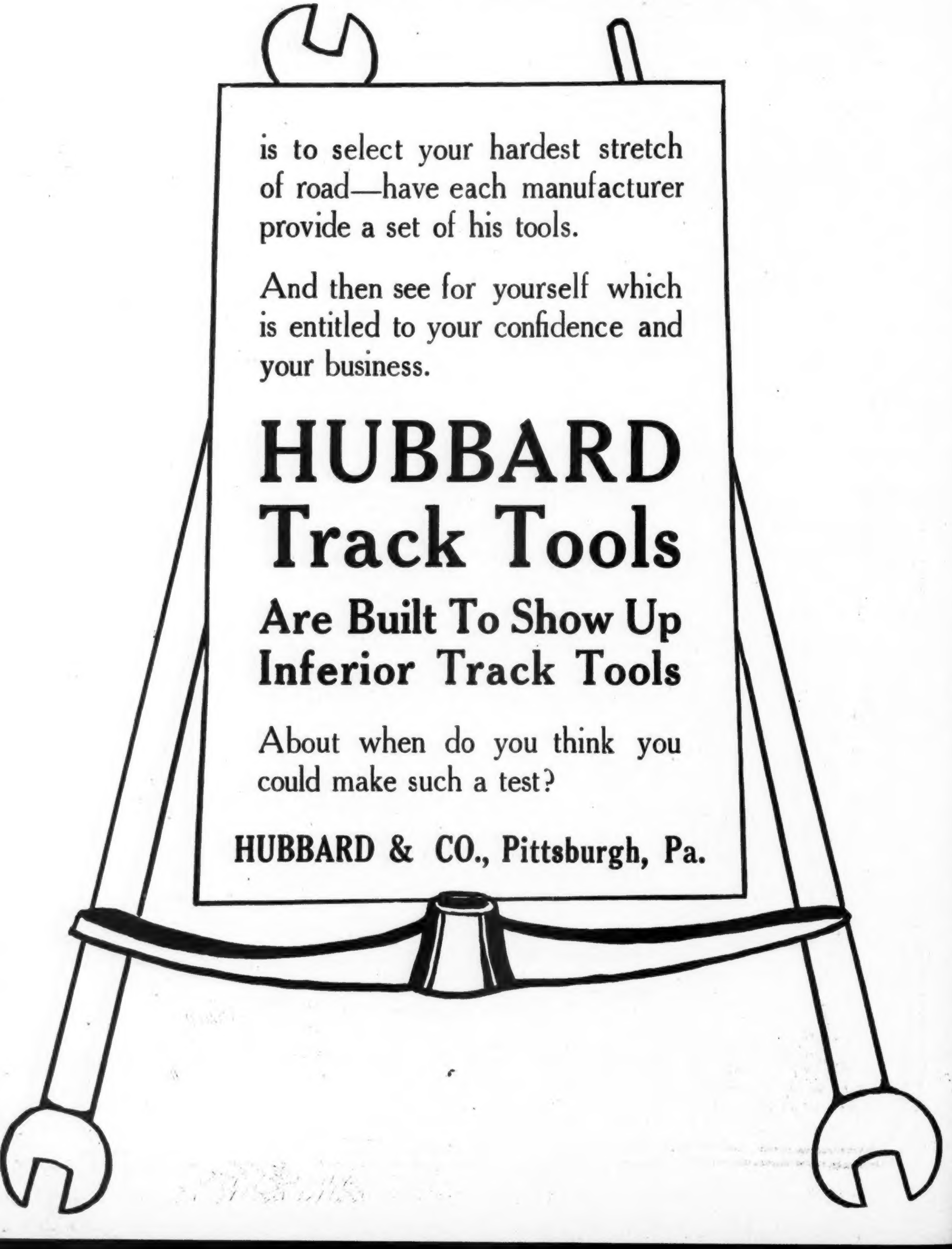

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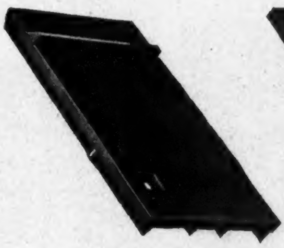

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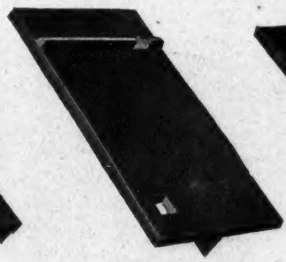

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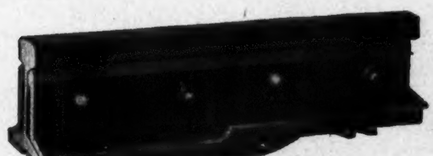

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RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

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BRIDGES--BUILDINGS--CONTRACTING--SIGNALING--TRACK

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CONTENTS.

†Editorial.
*Illustrated.

Constructive Criticism.

CRITICISM is valuable and in many cases leads to betterment, provided the criticism is constructive. That is, provided it is given in such a way as to suggest a possible remedy. It is even better to include as a part of the criticism, actual detailed suggestions for improvements.

Criticism given in the above manner and in a friendly spirit, is welcomed by all broad-minded individuals, who not only accept it but value it as a means leading toward greater efficiency.

There are, however, some persons who criticise things just from pure pleasure in fault finding. Others have acquired the habit of criticising and do it almost sub-consciously.

Some men are wont to criticise harshly those things in which they have not been directly concerned or consulted. This characteristic occasionally leads to acrimonious debate at conventions, where the discussions bring out absolutely nothing but the antagonism of the opponents of a committee. Such criticism or fault finding is not only valueless, but serves to show plainly the small and jealous nature of the critic.

The employer who criticises from force of habit creates a very disagreeable atmosphere, and is a hard man to work for. His criticisms cannot be taken to mean anything. Good and bad features are alike condemned and criticised, with the result that the employe despairs of ever doing anything satisfactory and loses interest.

Criticism should, in many cases, be forcible. It is made so, however, by its very absence except in cases where it is absolutely deserved.

It is always easy to pick out flaws in the method, after the work has been completed, for usually conditions are uncovered which could not be foreseen by the employe. The employer, who has presumably had wider experience, should be able to so inform and instruct his employes that criticism of methods would, in general, be unwarranted.

Some persons make a point of criticising, even in a constructive way, at the wrong time and place, and in a manner to attract the attention of all those within hearing. This is the contemptible method used by some men in front of their superiors to show what stern disciplinarians they are. Such behavior is extremely impolitic and results in antagonism which prevents even the best suggestions from being acted on.

A word of commendation is worth a hundred criticisms to the conscientious man who is doing his best with the materials furnished and conditions imposed.

Criticise if necessary, but not until suggestions or instructions for betterment can be given. Each year we approach nearer that point where an official, to be successful, must have the sympathy and support of all of his conscientious subordinates.

Jeffery Shops, W. P. Ry.

THE DESCRIPTION of the Jeffery shops of the Western Pacific Ry., on another page of this issue, exemplifies the present strong tendency to provide fully for future extensions. The importance of so doing is impressed on the mind of the engineer almost from the beginning of his training.

The problem is many times a difficult one—to so lay out a certain portion of the plant with proper provisions, and yet

avoid too much lost motion or waste of materials and land, in the original installation.

Many shops, as well as many train yards, have just grown up, and the present arrangement of such a shop shows that there was no engineering talent consulted before erection.

Somewhere in the railway organization, there is, or should be, an official who has sufficiently in mind the contemplated future developments and extensions of the road, and the natural or stimulated increase to be expected in the business of the road, to be able to approximately forecast the requirements of important facilities at all points on the line. The exercise of such knowledge is Engineering in its truest sense.

The cost of maintenance and operation are so vitally connected with the layout of any large railway facility, as to justify very extensive preliminary studies, if properly directed. And while in many cases the young engineer considers the collection and compilation of facts and figures relating to such subjects as work unworthy of an engineer, in reality there is nothing which tends to a greater broadening, or gives a greater ability to grasp and analyze a proposition in its entirety.

Shipping "F. O. B. Our Line."

THE practice is common on railways, not only in engineering supplies but in others, to call for quotations on material delivered, not to the place where it is used, but to any point on the railway line ordering it, from where it is shipped (presumably free) to its destination.

There may be some places in which this procedure is justified, but it certainly seems extremely uneconomical in a great many, probably in the majority, of cases.

During slack seasons, it is probable that such shipments, in helping to fill out tonnage trains, are of considerable help and there are real benefits, even though the distances the material is moved seem excessive. A few minutes consideration, however, would establish beyond possibility of a doubt, the saving effected or the expense added, and these few minutes would certainly seem justified in large shipments.

One of these cases has been brought to light where a contractor hauled his material in free of freight charges on the railway for which he was doing the work. Gravel for concrete work was shipped 750 miles, saving the contractor 5c per cubic yard, at a cost to the company, on conservative estimate, of at least 15 cents per yard. Similar shipments of Portland cement were made, although quantities of either material were conveniently available to the construction. It is probable in this case that the contractor shrewdly had this agreement incorporated in his contract, and then took advantage of the fact, and the railway was helpless. Such necessity, however, cannot be shown where the purchasing department quotes "F. O. B. Our Lines," without regard to *ultimate saving* or *ultimate economy.*

An instance of another inexcusable condition will serve to illustrate this point. A short spur was ordered by a Traffic Department to facilitate logging operations on a tract of land. The construction was very expensive, due to swampy ground, and a recapitulation later showed that the *total* revenue derived was less than the cost of the line. The Traffic Department, however, had shown temporarily a nice record on increased shipments. The Traffic Department made a record. The Purchasing Department makes a record by (ostensibly) saving a part of the freight charge on a shipment. The Operating Department is looking after larger things. And the Railway pays an excess over the proper costs.

Maintenance Methods.

CONSIDERABLE has been recorded in these columns regarding the relative advantage of handling maintenance work entirely by section gangs, (of sufficient force to handle the work) or by using extra gangs in addition to smaller sections gangs.

As expected, the majority of track men are in favor of doing large renewal work such as relaying and high track lifting, with extra gangs. The present labor conditions practically make it necessary to handle the work in that way.

Regular section work, however, cannot be handled at all successfully with large extra gangs. We refer to such work as smoothing up track, etc. It is very seldom that good tamping is done by an extra gang, unless there is a raise of two inches or more. It is almost impossible for a foreman to oversee a large number of men, and compel them to dig out and tamp up ties where the track has been lifted only a half inch. As a rule, an extra gang laborer will not dig out and tamp under a tie which has been raised only about a half inch. Most of his energy is expended in mutilating the side of the tie, and the track is left in worse shape than if not raised at all.

There is practically none of the work of extra gangs which the section gang cannot do more lastingly, provided, however, a sufficiently large gang is furnished and the section foreman is thoroughly capable. The section laborers, under competent supervision, become very thorough in their work. They are used to tamping up track which has been smoothed over, and they generally tamp under the ties. Conversely, the extra gang is not at all fitted to do much of the regular work of the section gang. And no large extra gang should be put on small section repair jobs.

It is our opinion that the extra gang should be made a section gang, so far as may be possible, by being placed in charge of a foreman permanently in the employ of the railway; preferably an unusually thorough and capable section foreman.

Some railways hire transient foremen, evidently because they may be layed off without compunction, whenever it is considered advisable to cut down expenses, or when the work is done. This is a short sighted policy. Cases have come to our attention where such an irresponsible foreman has collected enough graft in three months to have paid a first class reliable and honest foreman the balance of the year. And, not only that, but the gangs were spoiled for their successors; the men continued to expect pay for overtime which they never put in, but which they had been awarded on shares, by the transient foreman.

The Atchison, Topeka & Santa Fe will start construction on a new passenger station at San Diego, Cal., about January 1, it is said.

The Baltimore & Ohio will build a storage yard at Green Spring, W. Va.

Rochester Passenger Station N. Y. C. & H. R. R. R.

The New York Central & Hudson River R. R. has practically completed a large, attractive station at Rochester, N. Y.

The main building is 263 x 133 ft. and is placed similarly to the present station on the south side of the main tracks, two blocks east of the latter. Instead, however, of having a great train shed for the protection of passengers with access to the tracks on the grade, necessitating the crossing of them by the passengers in order to reach their trains, the access to the trains in the new station will be by subways with stairways to the platforms, which will be protected from the weather by canopies according to modern practice.

The station itself is of simple but rich style of architecture; the main facade is of red brick, trimmed with soft colored sand stone and consists of three great central arches, flanked on either side by simple but somewhat massive pavilions of four stories each, about equal in height to the arches. The two pavilions contain the divisional offices.

The arrangement of the first floor of the station is shown herewith. The information room and parcel room are to the right of the main entrance and beyond these are the ticket office, baggage room, and then the exits to the concourse.

Rochester Station, N. Y. C. & H. R. R. R.

Waiting Room.

The main waiting room has 3 pairs of large twin arches opposite each other, i. e., arranged symmetrically on the Central Ave. and the concourse sides of the building. These arches appear on the exterior of the building, as shown in the illustrations.

The waiting room is in the center of the building and is entered directly from the street, but is a few feet below its level, the difference being made up by a descent of a few steps which is made an architectural feature of the interior. The waiting room itself is 190 feet long and 90 feet wide and 60 feet in height, having for its ceiling a vaulted elliptical arch of Gustavino tiling. The general tone of the interior is a soft light brown. The side walls are of tapestry brick, all giving a very pleasing effect to the eye. The floors are of terrazzo and the wainscoting generally of tile. The roof is arched with ornamental brick.

On the mezzanine floor, 6 feet above main floor, is a barber shop, postoffice sub-station, gallery, station master's and miscellaneous rooms. These rooms all have terrazzo floors and red oak finish.

The building contains all the modern station facilities. It is heated by steam, the main pipes of which are located on a pipe gallery of ample size surrounding the building. The pipe gallery contains also the various other mains and conduits for the building service.

At the easterly end of the depot is located a large wing for the accommodation of baggage and express business. There is also in the building a large postoffice for the United States mail service.

Track Layout.

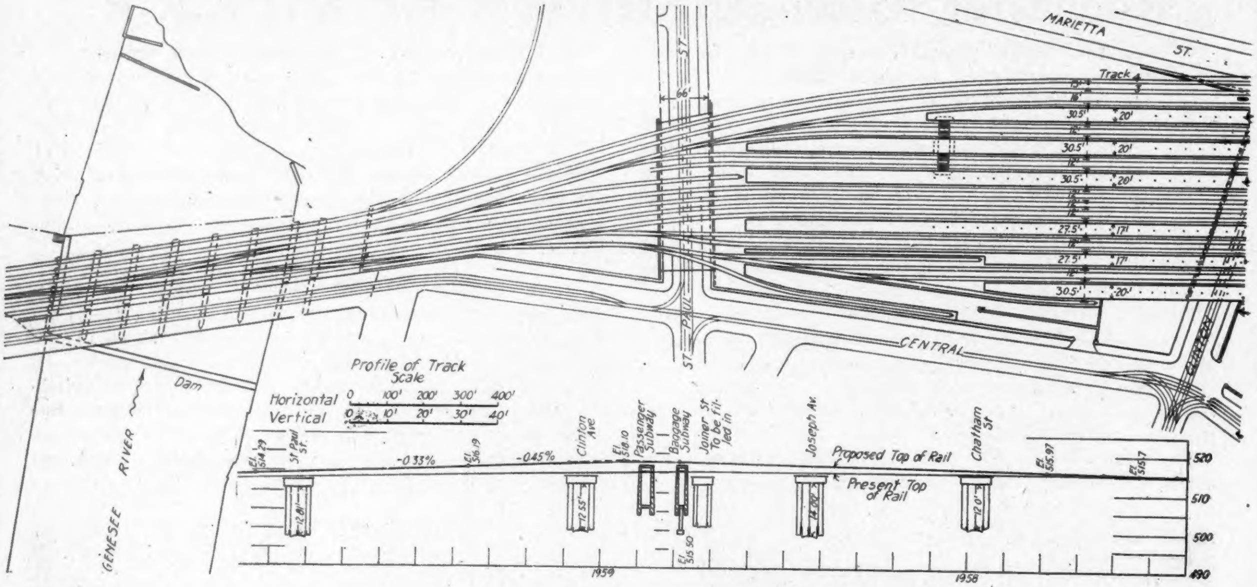
There are 11 tracks in the station not counting four main through tracks. These tracks will accommodate about 18 cars each, and there are in addition, a large number of service and switching tracks. At each end of the yard, where the switching ladders spread out from the main tracks, the main line tracks are spread apart to accommodate a switching lead between the two middle tracks of the four, which arrangement takes care of the work in the station yard. The two through freight tracks are located at the outside of all the station tracks and the two express passenger tracks are the two middle tracks of the station and have no platforms.

The station is a through station, which of course, requires less trackage than a stub terminal. The track layout reproduced herewith, shows several features of interest.

The switches are all simple switches, which is unusual in recent layouts at stations of this size. The stub tracks, at ends of platforms, are used for storing cars without blocking any of the platform tracks. This feature should tend to cut down the train moves to and from the coach yard. The gradient into the station from the east end is + 0.1848. There are six tracks at the throat of the station yard, and practically all of the switches are No. 10 turnouts.

The gradient into the station from the west is + 0.33, and the alignment is tangent, to the throat of the station yard. This differs from the east approach, which is on a curve that is straightened into a tangent at the throat where most of the turnouts are located. The tangent layout at this point, prevents the occurrence of any higher degree of curvature than in an ordinary No. 10 turnout, exceptionally light for a large station.

The station roof consists of a concrete slab, supported by four 3-hinged, 3-centered roof truss arches with a span of 86 ft.,



Track and Station Layout, Rochester, N. Y.

spaced on 48 ft. centers. The radii are 21 ft. 6$\frac{3}{16}$ ins., 28 ft. 8$\frac{1}{16}$ ins., and 63 ft. 4 ins., with a total rise of 29 ft. 4 ins.

The lower chord is a plate box girder made up of two 21 in., 25 lb. channels back to back, one bottom plate 12x$\frac{5}{16}$ ins., two bars 3x½ ins., and two 10x¼ in. side plates, the maximum compression being 333,000 lbs. near the support. The struts and diagonals are angles, latticed in pairs, each riveted to the inner side of the box girder lower chord. The tension chord is also made up of angles. The roof slab is supported by transverse angles riveted to longitudinal I-beams at each panel point of the truss, the latter varying from 5 ft. 2 in. centers, to 7 ft. 3 in. centers.

The platforms are 1200 feet long and 20 feet in width and are located between each pair of tracks. The platform canopies are supported on rows of columns in the center of platforms. Each column is supported on one 16 ft. creosoted pile, except where not deemed necessary. The profile of the canopies follows the profile of the track. Drain pipes are located at every third or fourth column. Provision has been made for the future extension of platforms and canopies to the west when conditions necessitate.

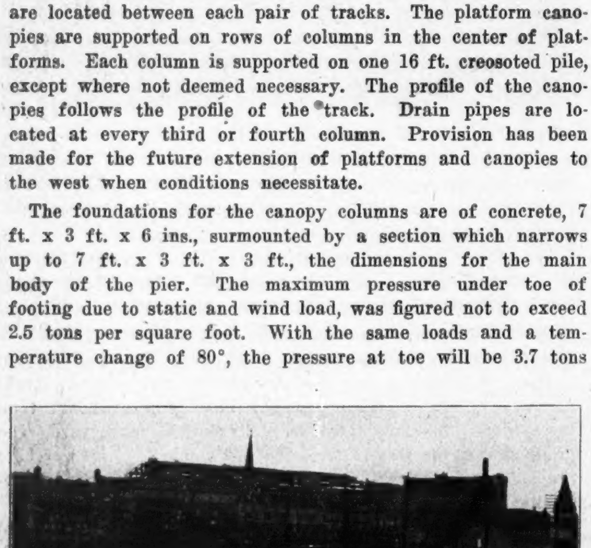
The foundations for the canopy columns are of concrete, 7 ft. x 3 ft. x 6 ins., surmounted by a section which narrows up to 7 ft. x 3 ft. x 3 ft., the dimensions for the main body of the pier. The maximum pressure under toe of footing due to static and wind load, was figured not to exceed 2.5 tons per square foot. With the same loads and a temperature change of 80°, the pressure at toe will be 3.7 tons per square foot. The earth was well compacted around footings before canopies were placed. The canopy column of four angles 3½x$\frac{3}{16}$ ins., and 9x$\frac{11}{16}$ in. cover plate, is anchored in the concrete by 1⅜ in. bolts 2 ft. 8 ins. long. The top of the vertical connection plate between column and base plate is 2 ins. below the platform top. Pairs of angles are bent out at the top as canopy supports, riveted to the column angles, the canopy curved angles being tied together by angles supporting the 5 ply tar and gravel roof. The drainage is to the center of roof with a slope of 1$\frac{5}{16}$ ins. in 1 ft.

The baggage, express and mail are handled by means of elevators in each paltform large enough to handle trucks to a separate subway, thence to the station.

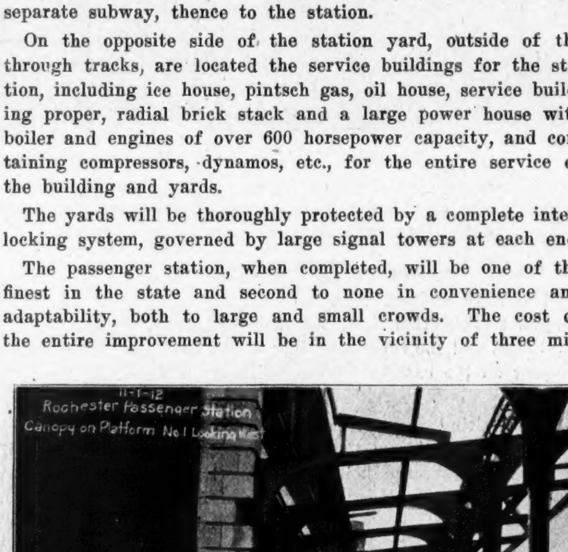
On the opposite side of the station yard, outside of the through tracks, are located the service buildings for the station, including ice house, pintsch gas, oil house, service building proper, radial brick stack and a large power house with boiler and engines of over 600 horsepower capacity, and containing compressors, dynamos, etc., for the entire service of the building and yards.

The yards will be thoroughly protected by a complete interlocking system, governed by large signal towers at each end.

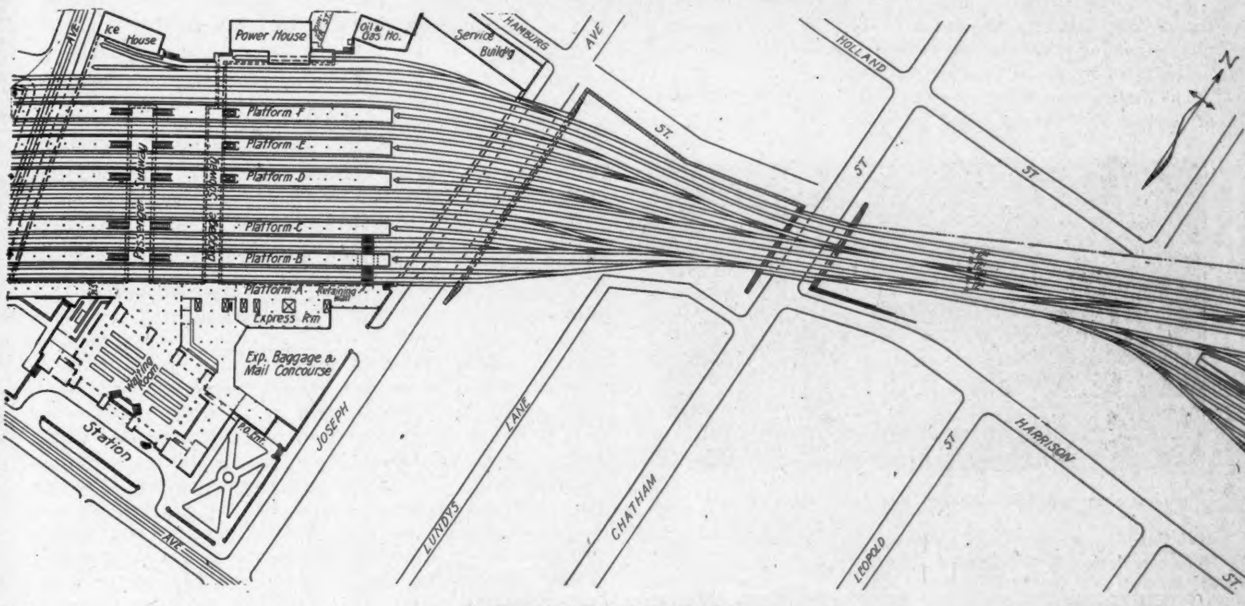
The passenger station, when completed, will be one of the finest in the state and second to none in convenience and adaptability, both to large and small crowds. The cost of the entire improvement will be in the vicinity of three mil-



View of Structural Steel Frame.



Canopy, Platform No. 1.



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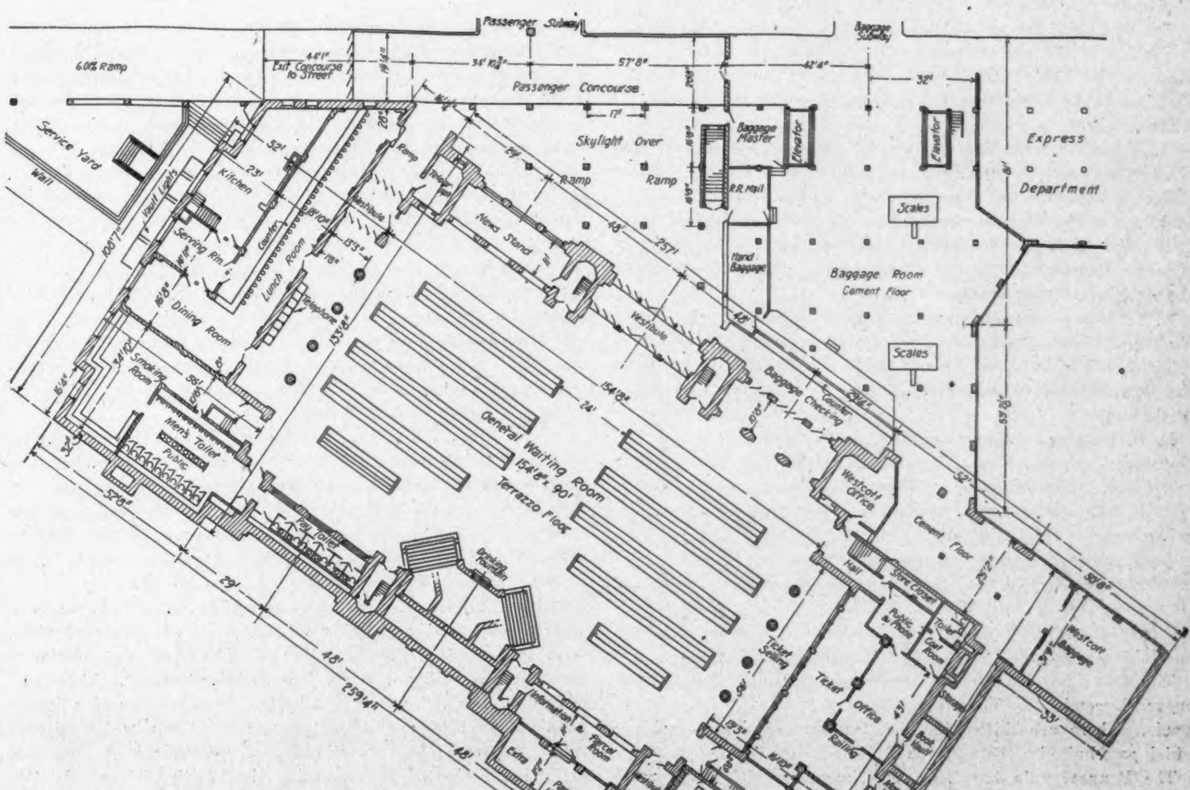


Floor Plan, Rochester Station.

lion dollars, including the track work, platforms and canopies, signaling and various street changes that have been necessitated by the erection of the station.

The station was designed and erected under the supervision of George W. Kittredge, chief engineer of the New York Central lines, to whom we are indebted for the data from which this description was prepared.

Ornamental Brick Arched Roof, Rochester Station.

Twenty Years Ago This Month

(From the Files.)

The Manchester ship canal was opened December 7. It is 35½ miles long and cost $75,000,000 or $2,100,000 per mile.

The first prize for maintenance of track, following the annual inspection of the Pennsylvania, went to James R. Smith, supervisor of the New York division. The prize for the best subdivision went to John Rourk, foreman of subdivision number 4, Altoona yards.

H. Rittenhouse has been appointed assistant engineer of the Norfolk & Western, with office at Crewe, Va.

George M. Hall, has been appointed foreman of bridges and buildings of the Texas & Pacific with office at Weatherford, Tex.

The list of insolvent railways was increased with startling effect on December 23 by the announcement of a receivership for the Atchison, Topeka & Santa Fe.

A. L. Mohler has resigned as general manger of the Great Northern on account of the poor condition of his health.

The South Side Rapid Transit Co. has closed a contract with the Rowell-Potter Safety Stop Co. to equip its line with automatic stops.

E. B. Cushing, resident engineer of the Southern Pacific at Houston, Tex., has been given charge of all new construction and general supervision of maintenance of track.

R. H. Hilyard has been appointed superintendent of tracks, bridges and buildings of the Ft. Worth & Rio Grande.

A company has been organized at Cleveland, Ohio, for the manufacture of steel ties, the invention of Charles Golden, of that city. De F. Lillis and J. P. Lancaster are interested in the new organization. The Lake Shore & Michigan Southern has laid a number of these ties for testing purposes.

The first interlocking machine on the Missouri Pacific was opened December 8. The plant is located at 20 Third street, St. Louis. There are thirty-nine working levers in the machine, which was built by the Johnson Railroad Signal Co.

The Pennsylvania has been experimenting with 60-ft. rails and has found them satisfactory. It is said that the saving in joints amounts to about $600 per mile. It is predicted by officers that the long rails will supplant the present 30-ft. lengths.

Richard Newell, chief engineer of the Midland Terminal, was shot and killed December 19 at Cripple Creek, Colo., by a man with whom he had had right of way trouble.

Chief Engineer Kittredge, of the Cleveland, Chicago, Cincinnati & St. Louis is arranging to contract for a bridge over the Wabash river at Wabash, Ind.

SOLDIER SUMMIT DETOUR LINE.

That portion of the Denver & Rio Grande constituting the through route between Denver and Ogden crosses two distinct mountain ranges, one in Colorado and the other in Utah. The mountain pass in Colorado lies in the main range of the Rocky mountains and constitutes the continental divide. The range in Utah, known as the Wasatch mountains, and intersected at Soldier Summit, constitutes the easterly rim of the Great Basin.

Prior to the year 1890 the Denver & Rio Grande portion of the transcontinental route was operated from Denver to Ogden as a narrow gauge line, crossing the Rocky mountains at Marshall pass, thence following the Gunnison river to its junction with the Grand river at Grand Junction. During the year 1890 the narrow gauge line extending over the Rocky mountains via Tennessee pass to Glenwood Springs was made standard gauge, and a standard gauge connecting link constructed from Glenwood Springs to connect at Grand Junction with the Rio Grande Western, which was at that time being widened to standard gauge. In the standard gauging of the old narrow gauge line west of Tennessee pass, the four per cent gradients were reduced to maximum gradients of three per cent between Tennessee pass and Minturn, and upon completion of this work of standard gauging, the Tennessee pass line was made the transcontinental route. Since that date main line operations have been conducted over three per cent maximum gradients descending westerly from Tennessee pass to Minturn, about thirty miles, and four per cent gradients descending westerly from Soldier Summit to Tucker, Utah, a distance of seven miles.

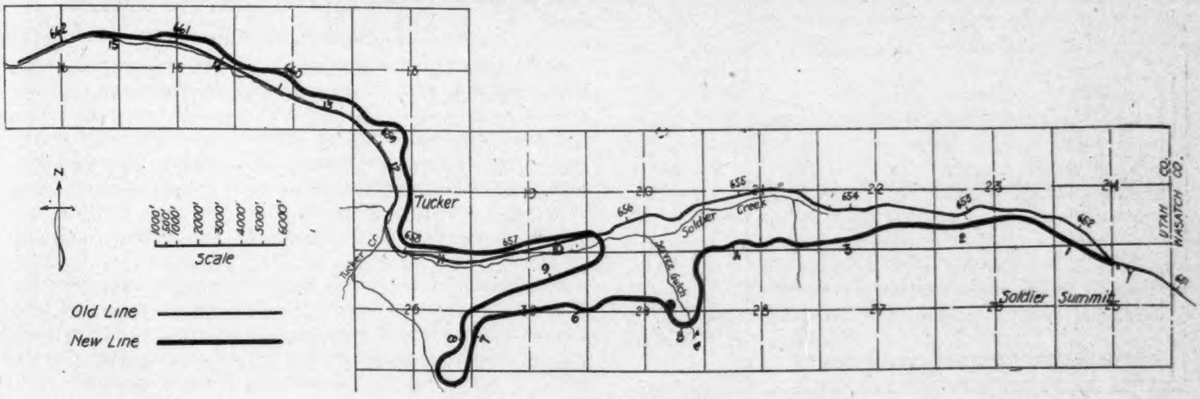
The two mountain ranges, namely, the main range of the Rocky mountains in Colorado and the Wasatch range in Utah, are similar in the fact that the passes over both are approached from the east on very much lighter gradients than the descent on the West. For example, the maximum gradients ascending from the east towards Tennessee pass in Colorado are 1.42 per cent, while descending gradients on the western slope are three per cent maximum, while the ascending gradients to Soldier Summit in the Wasatch mountains from the east are 2.40 per cent and the maximum descending gradients from Soldier Summit westerly are four per cent.

On account of the growth of traffic, the line between Soldier Summit and Tucker was made double track in the year 1900, and from time to time thereafter the second track was extended at various critical points, so that now the double track is continuous throughout the Wasatch mountains from Helper to Thistle, a distance of fifty miles.

At various times in the past surveys have been made in an endeavor to eliminate the four per cent gradients between Soldier Summit and Tucker. The physical characteristics of this portion of the Wasatch range and the topography of the country adjacent to the present line seemed to impose unusual difficulties for the development of a line on the westerly slope to such an extent as would permit material reduction in the maximum gradients. In 1909 extensive additional surveys were made and the problem studied from all points of view, with the result of final adoption of a two per cent maximum gradient descending westerly from Soldier Summit. These surveys brought out the fact that by taking advantage of a lighter gradient west of Tucker and constructing a new line fifteen miles in length, the seven miles of four per cent gradients could be eliminated by increasing the length of line only 4.46 miles.

Physical Characteristics of the New Line.

As might be expected, the detour line, on account of necessary development of distance, contains a much larger amount of curvature than the old line. The maximum rate of curve is nine degrees, but only at a few instances was it necessary to employ the maximum rate, such cases being usually on the loops. While, generally speaking, the detour line is on two per cent supported gradient, compensated for curvature through-



New and Old Alinement, Soldier Summit Revision.

out its entire length, yet at passing tracks this gradient is flattened for facility in operation.

The line was constructed as a double track line with the two tracks laid on 15-foot centers. The roadbed, therefore, necessitates a top width of 35 feet. Owing to the fact that the line throughout its whole length lies so close to the summit of the range, ample waterways are provided for both normal and flood flow of streams by the use of comparatively small waterway openings. In fact, the largest opening is a 12-foot concrete arch and all stream crossings were effected by the use of some form of concrete culvert.

Construction.

The contract for the grading and masonry on the entire line was awarded to the Utah Construction Co., Ogden, Utah, and work started in January of this year. Great difficulties were encountered by the contractors in getting equipment on the line, on account of the mountainous character of the country and the wide divergence, at various places, of the new from the old line. At some points temporary tracks were laid to the new line and the steam shovels moved under their own power over these temporary tracks, while at others steep inclines were constructed and the steam shovels hauled up the inclines by cables. These difficulties were considerably augmented by the requirement that the entire construction must be effected in a few months and the line placed in operation this fall. This fact necessitated an abnormally large amount of equipment force, reports showing that at one time twenty steam shovels were at work. Some of these, in addition to working day shifts, were required to work night shifts for weeks at a time.

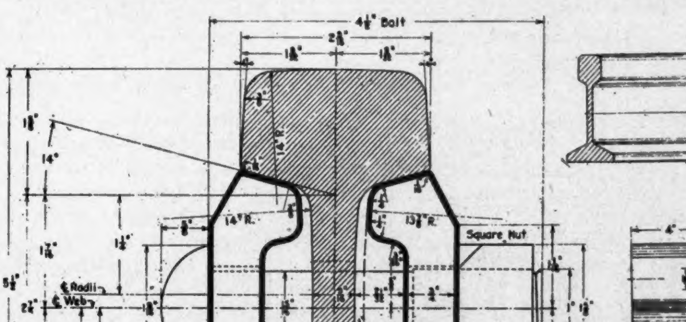
Generally speaking, most of the work of grading was performed by steam shovels and contractor's trains. The grading quantities moved consisted of approximately 3,500,000 cubic yards of material, about 33 per cent of which was solid rock, and the masonry work comprised the placing of about 13,400 cubic yards of mass concrete.

Tracks are laid with D. & R. G. section 90-pound rail rolled for the first time this year. Tie plates were placed on every tie and a liberal number of anti-rail creepers installed. The track is ballasted with a minimum of ten inches of gravel from the famous Jordan Narrows gravel pit.

Traffic.

Freight traffic on this portion of the line consists principally of coal and coke produced in Emery and Carbon counties, Utah, this freight being collected by various branches and spurs from the main line on the easterly slope of the Wasatch mountains. The loaded movement is almost exclusively westward, the empty cars being hauled eastward to supply the demand for loading. The old four per cent gradients had the effect of limiting the capacity of the line for the reason that the tonnage per train down the hill was limited by the capacity of the air pump on the locomotives.

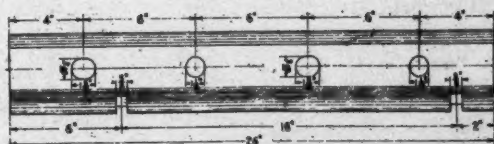
Passenger traffic consists of three regular heavy through passenger trains each way per day. During the summer months the passenger traffic necessitates the operation of additional sections of these trains.



SECTION OF RAIL AND SPLICE

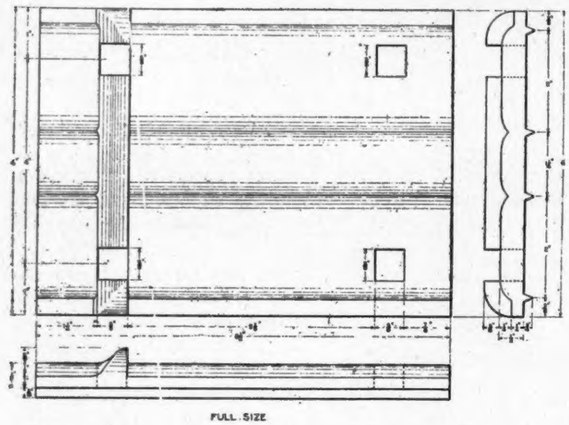
Standard D. & R. G. Section Rail.

DRILLING OF RAIL



PUNCHING OF SPLICE BAR

Standard Angle Bar.



Standard Tie Plate.

It is, therefore, apparent that the operation of the two per cent line will effect great economies in operative expense, notwithstanding the fact that the new line is about four and one-half miles longer than the old.

The entire work of construction was carried on under the personal supervision of Mr. J. G. Gwyn, chief engineer of the Denver & Rio Grande R. R.; Mr. L. B. Furman, construction engineer, being in direct charge of location and construction. We are indebted to Mr. Gwyn for the data contained herein.

The Canadian Northern has awarded a contract to the Canadian Northwest Steel Company, Vancouver, B. C., for the erection of a steel bridge at Kamloops, B. C.

The Central of New Jersey has taken bids on a three-story station at Scranton, Pa., to cost $200,000.

The Railroad Commission of Wisconsin has directed construction of a viaduct over the C., M. & St. P. tracks at Rose street, La Crosse, Wis., to cost $83,000.

The Chicago, Milwaukee & St. Paul R. R. contemplates a viaduct over the tracks at Polk street, Chillicothe, Mo.

The Delaware, Lackawanna & Western is asking for bids on the steel for its new station at Buffalo, N. Y.

The Delaware, Lackawanna & Western has awarded a contract to Hyde-McFarlin & Burke Company, New York City, for elimination of grade crossings through Madison, N. J.

The Erie has started work on twk new freight houses and dock at Chicago, Ill.

F. L. Fellows, city engineer of Vancouver, B. C., is drawing up plans, it is said, for the construction of five steel and concrete bridges over the tracks of the Great Northern.

JEFFERY SHOPS OF THE WESTERN PACIFIC.

By W. E. Johnston, Chief Draftsman.

At the time regular operation of the Western Pacific Railway was begun in 1910 all of the equipment was new except a small amount used in construction. The repairs to locomotives were therefore light and could be handled reasonably well at the various roundhouses. Anticipating the necessity for more elaborate shop equipment as the rolling stock became older, the company began construction nearly two years ago and has now completed its new plant, known as the Jeffery Shops, in Sacramento, Cal.

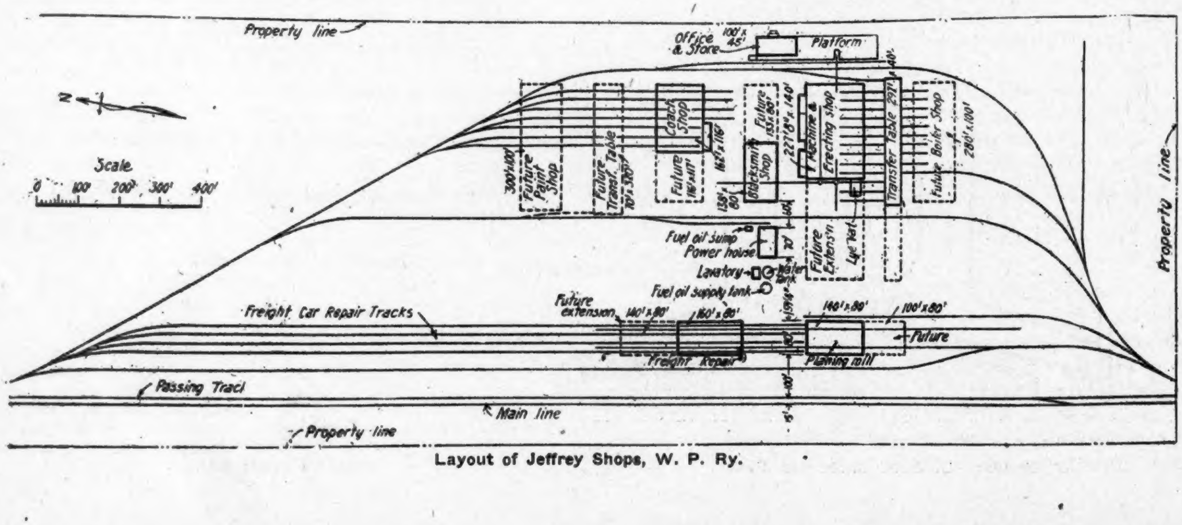
The history of practically all railroad shops has been one of gradual growth, and many times insufficient space has been allowed both as to the shop grounds as a whole and between the various buildings to which extensions have become necessary. In laying out the general plan of these shops, the probability of future growth has been kept in mind and ample provision has been made for a very large increase; in fact, the shop was laid out as a large plant and only a part of it has been erected to fill present needs.

A plat of the shop layout is reproduced herewith. The buildings shown in solid lines are those which have now been erected. Future extensions and future buildings are shown in dotted lines. Tracks serving the various buildings are arranged to enter the shop grounds from both ends to facilitate switching. No turntable has been provided, but there is a "Y" on the main line near the shop site, on which locomotives from the eastern terminals are turned so as to head into the erecting shop.

Machine and Erecting Shop.

The machine and erecting shop is the largest of the buildings, 140′ wide by 227′ 8″ long, and contains ten pits. Provision has been made to extend it to a length of 445′, which will accommodate twenty pits. The building has one main bay in which the erecting pits and the heavier machine tools are located, and a side bay for the lighter tools. The structure has a steel frame with reinforced concrete walls, except the end toward the future extension, which is of wood. The sawtooth roof over the side bay and the large windows in the main bay give exceptionally good illumination. The sash in the upper windows of the main bay and the sawtooth roof of the side bay are controlled from the floor by sash operating devices giving sufficient natural ventilation. Owing to the mild climate, very little artificial heat is necessary, and small direct steam radiators between alternate pits on the erecting side and three similar ones on the machine side are considered sufficient. Connections have been provided at each pit for air, steam and water, the mains for all being carried under the floor in a duct which has removable covers so that any part of the piping can be reached conveniently.

The main bay is served by a Shaw 120-ton six-motor electric



Layout of Jeffrey Shops, W. P. Ry.

traveling crane which has two main hoists of 60 tons capacity each, and one auxiliary hoist of 10 tons capacity. The speed of the main hoists is eight feet per minute, of the auxiliary hoist twenty-four feet per minute, and of the bridge travel 200 feet per minute. This speed of bridge travel, while higher than usual for such a heavy crane, has proven entirely satisfactory and adds materially to its usefulness on light work. The span of the crane from center to center of runway rails is seventy-four feet six inches. Alternating current motors of the wound rotor or slip ring type are used throughout the crane and have given entire satisfaction. In the side bay the roof has been placed at a height such that a traveling crane can be installed when considered advisable. At present, machines on which heavy pieces are handled are provided with individual jib cranes of capacities as required.

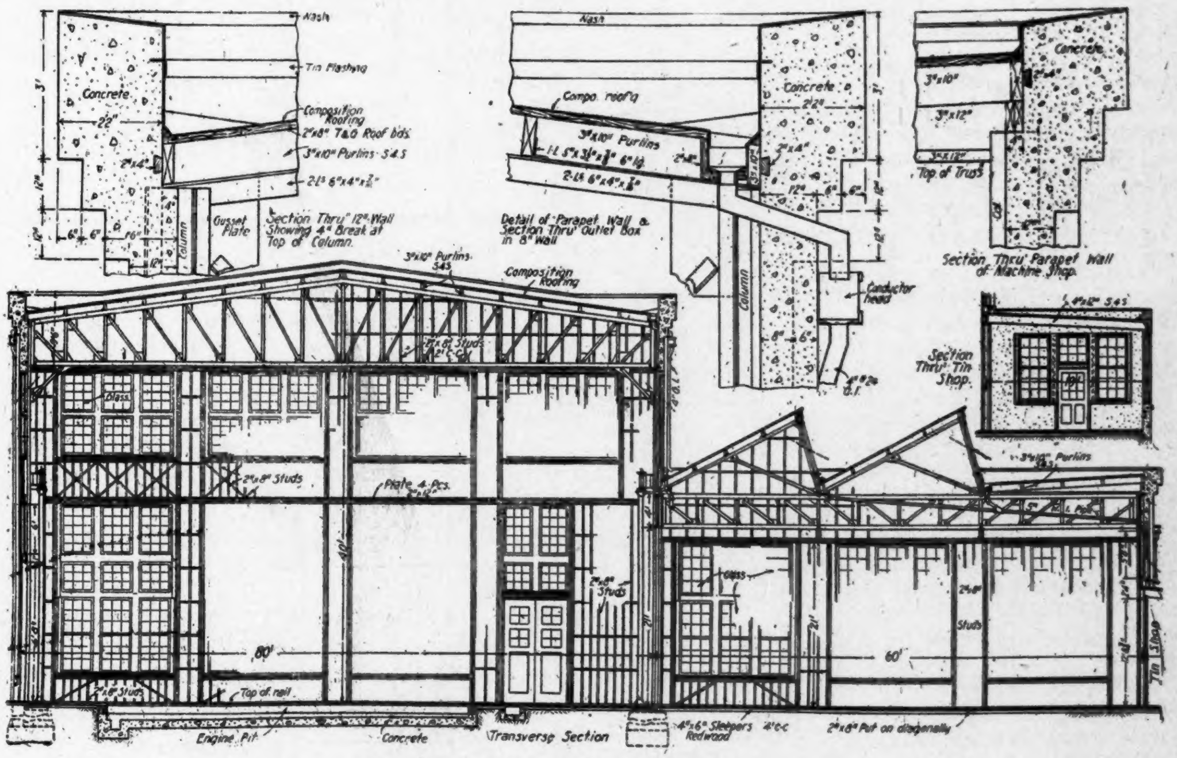
The machinery in the main bay is located so as to be served by the auxiliary hoist on the 120-ton crane. The machinery in the side bay is located on each side of a track running length-

loaded onto push cars at the rear end of the locomotives after the wheels are removed, and are taken to the lye vat and cleaned and then passed on to the machine or blacksmith shop as required.

The adoption of individual motor drives for all the machinery simplified the arrangement greatly, making it possible to locate every machine in its most convenient location and eliminating all shafting and belting. Most of the motors are of the constant speed type, speed changes being secured through gear boxes. For several old tools, which were originally belt driven, multi-speed motors of the constant horsepower type having synchronous speeds of 1800, 1200, 900 and 600 R. P. M. have been used. The different speeds on these motors are obtained by changing the number of poles in the stator windings by means of drum controllers.

Blacksmith Shop.

The blacksmith shop is 81′ 0″ wide by 138′ 0″ long, of same type of construction as the machine and erecting shop. The



Section of Machine and Erecting Shops.

wise of the shop and served by a turntable at the end. This turntable also connects with the track to the blacksmith shop. The lye vat is located by the side of this latter track, between the transfer table and the tracks leading into the machine shop. This vat and another leading off from the transfer table are both served by a pneumatic jib crane. The object of this arrangement is to concentrate the cleaning of all greasy parts at a point on the natural line of motion from the pits, on which the stripping is done, to the machine shop and blacksmith shop. The method of operation, in the case of driving boxes, for example, is to lift the locomotive with the crane, roll the wheels with the boxes in place out from under, and onto the transfer table which brings them to the track past the lye vat. As the wheels pass the vat, the boxes are dropped off and put into the vat, and the wheels are cleaned and passed along to the turntable leading into the main bay to the wheel lathe and wheel press; or if new tires are required the wheels are run out in the opposite direction onto a stub track provided for this purpose. Driving springs, saddles, pedestal binders, etc., are

height of 22′ 3″ to the roof trusses and 27′ 6″ to the roof proper, gives a light, airy shop free from gases without the use of elaborate smoke removing appliances. As in the machine shop, all the power driven machinery is individually driven by electric motors. This has been found especially advantageous, as it has permitted ample spacing between machines and the location of any machine in the exact position desired.

Power House.

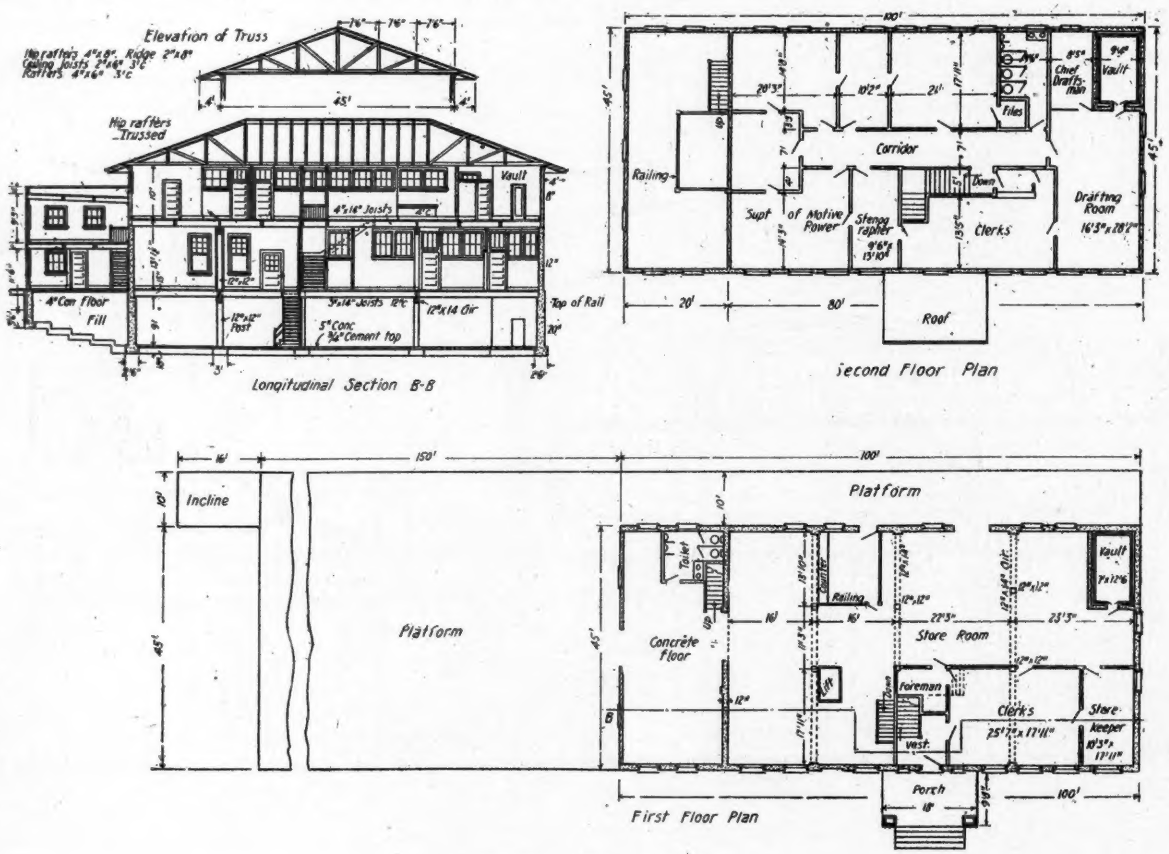
The purchase of electric current from an outside concern, and the fact that there are competing concerns capable of furnishing the current from water power plants, has made an electric generating plant unnecessary. Steam for the steam hammers, for the operation of pumps, and a small amount occasionally for heating in the winter months, is all that is required, and this is furnished by two 125 H. P. oil burning Scotch marine boilers. A reinforced concrete chimney, 48″ by 80′ 0″, which has sufficient capacity to handle four 125 H. P. boilers, has been erected in preference to either a self-supporting steel or brick stack on account of its lower first cost and greater dura-

bility. The two Underwriter pumps for fire protection and boiler washing have a capacity of 500 gals. per minute each, which is sufficient for four good fire streams. The cooling water from the air compressor and the water cooled transformers is run into an open feed water heater, which serves three purposes in saving this water with the heat there is in it, heating all the feed water to a high temperature and removing the encrusting solids.

Compressed air is furnished by a 1050 ft. two stage belted air compressor driven by a 200 H. P. 2200 volt constant speed motor. Variations in the consumption of air are taken care of by a choking unloader on the compressor.

Passenger Car Shop.

The passenger car shop is of the same type of construction as the other buildings. It has no machinery, as the company's entire passenger equipment is all-steel, and repairs, except in the case of a wreck, consist only of work on the trucks (which is small in quantity and is handled on the locomotive side for the present), the usual painting and varnishing and the necessary work on the interior furnishings, which is also light.



Storehouse and Office Building.

Planing Mill.

The planing mill is of wooden frame construction covered with corrugated iron. Tracks connected to the yard system run into one end of the building so that cars loaded with lumber can be brought directly to the machines, and so that shop order work for outside points can be loaded direct from the machines onto the cars. At the opposite end of the building, industrial tracks are provided leading into the repair yard, for handling lumber direct to damaged cars.

A shavings exhaust system is used to collect the shavings from the various machines and deliver them to a car on a siding near the mill. The exhauster is of the slow speed type and has a 60" wheel mounted directly on the shaft of a 50 H. P. motor running at a speed of 850 R. P. M. All of the machinery is individually driven by electric motors, giving entire freedom in the location of tools for the most economical handling of material.

Electrical Distribution.

A system of electrical distribution much more elaborate than that usually found in railroad shops was made necessary by the large number of individual drive motors required. Current is purchased from the Great Western Power Co., which has a large hydro-electric plant in the Feather River Canon on the line of the railway. The potential at the entrance to the shop site is 22,000 volts, which is stepped down to 2,200 volts by the power company's transformers.

General distribution to motors is at 220 volts and to lights at 110 volts. These voltages were originally adopted by the company in order to reduce the possibility of injury to workmen to a minimum, and have been adhered to in this installation for this purpose as well as to maintain a standard. The only exception is the 2200 volt air compressor motor, which is handled by an experienced operator and which is not in a place open to other employes. However, the danger to the operator is small, as the wiring is fully enclosed and the framework of the motor and the case of the compensator are thoroughly grounded.

The transformer house, located just west of the machine and erecting shop, is the center of distribution for the entire plant. As this is very close to the center of load of the machine shop and the blacksmith shop, the 2200-220 volt transformers for power and the 2200-110 volt transformers for light for these buildings are located in it. For the mill, the extra cost of separate transformers was less than that of the heavy copper

that would have been necessary for distribution at 220 and 110 volts, and the power and light for this building is, therefore, supplied by transformers located near it to which current is supplied from the transformer house at 2200 volts.

Distribution between buildings is entirely in lead covered, varnished cambric, insulated cables in fibre conduit, laid in concrete underground. There is, therefore, an entire absence of the usual unsightly pole lines. Distribution inside of buildings is entirely in galvanized metal conduit, separate circuits being provided for the distributing panels to each machine. The distributing panels are enclosed in steel cabinets, which are large enough to allow wiring spaces at the sides and back of the panels, thus allowing the wiring in the cabinets to be run back of the panels, although the connections to the fuses are all on the panel faces so as to be reached conveniently. Conduits containing the mains and branches are brought into either the top or bottom of the cabinets, as circumstances require, and are provided with lock nuts and bushings similar to the practice with steel cabinets for lighting panels.

Motors of 7½ H. P. and above are provided with compensators which have low voltage release attachments. Motors under 7½ H. P. are started with double throw switches, so arranged that they can not be left in the starting position. In the case of motors which are more than usually liable to overloads, overload relays are used. These act on the low voltage release on the compensators and eliminate fuse renewals as well as the delay incident to the replacement of fuses.

On the main switchboard in the transformer house, automatic oil switches are used on 2200 volt circuits, and automatic air brake circuit breakers with carbon auxiliary contacts on 220 volt circuits. Where required, these oil switches and circuit breakers are equipped with inverse time limit relays to avoid excessive sensitiveness to momentary overloads.

The design and construction of the buildings was handled by W. H. Mohr, architect, under the supervision of T. J. Wyche, chief engineer. Mechanical and electrical details were handled by W. E. Johnston, chief draftsman, under the supervision of J. E. O'Brien, superintendent of motive power.

DISCIPLINE RULES, CANADIAN GOVERNMENT RAILWAYS.

The Canadian Government Rys. has sent out the following rules of discipline:

It is the intention to insist on a more rigid compliance with the rules and regulations, which are made for the protection of the lives of the public and employees, as well as for the protection of the railway's property.

All employees will start with a clean record, beginning this date.

Any exceptional service rendered will be credited to the employee's record.

A monthly discipline list will be issued. This list will show cause, extent of discipline, or action and extent of reward.

Employees will, as heretofore, be subject to summary dismissal for insubordination, drunkenness on or off duty, using intoxicating liquor when on duty, frequenting saloons, or places of low repute, incompetency, dishonesty, failing to carry out train orders and rules respecting train movement.

Where previously discipline was meted out by suspension, demerit marks will be placed in the record of an employee. For every repetition of an offense by the employee, the number of demerit marks will be doubled. When the demerit marks against any employee number sixty, his services will be dispensed with.

For every twelve consecutive months, good service, free from demerit marks, an employee will have twenty demerit marks deducted from those that may stand against his record.

Employees will be advised when demerit marks are recorded against them, the same as they have hitherto been advised respecting disciplinary measures in the past.

Personals

Although we are publishing monthly in these columns a practically complete report of all appointments of interest to our readers, it is probable that this information could be published earlier if each subscriber would make it his business to notify us of new appointments immediately. We request and we shall appreciate your assistance in this respect.

Operating.

M. H. CAHILL has been appointed superintendent of the *Baltimore & Ohio R. R.* at New Castle Jct., Pa., succeeding H. H. TEMPLE, resigned.

GEORGE J. SHREEVE, formerly trainmaster, has been appointed superintendent of the *Belt Ry. of Chicago*, office at 83rd St. and Vincennes Road, Chicago, Ill.

JOHN ROURK has been appointed superintendent of the *Boston & Maine R. R.* at Boston, Mass., succeeding C. E. MCMULLIN, resigned.

F. WALKER has been appointed superintendent of the *Canadian Pacific Ry.* at Calgary, Alta.

E. E. NASH, formerly superintendent, has been appointed assistant general superintendent of the *Chicago & North-Western Ry.*, office at Chicago, Ill. M. J. BOYLE, formerly assistant superintendent, has been appointed superintendent at Winona, Minn. He succeeds J. W. DOYLE, who has been appointed superintendent of the Madison division at Baraboo, Wis., succeeding Mr. NASH.

E. H. ZEIGLER has been appointed acting superintendent of terminals of the *Cleveland, Cincinnati, Chicago & St. Louis Ry.* at Cincinnati, O., succeeding T. J. HAYES, transferred.

I. H. LUKE, formerly at Salida, Colo., has been appointed superintendent of the *Denver & Rio Grande R. R.* at Salt Lake City, Utah. J. T. SLATTERY, formerly at Helper, Utah, succeeds Mr. LUKE as superintendent at Salida, Colo. N. A. WILLIAMS, formerly superintendent at Salt Lake City, has been appointed superintendent at Helper, Utah, succeeding Mr. SLATTERY.

CHARLES W. BROWN, formerly engineer maintenance of way, has been promoted to assistant superintendent of the *Lehigh & New England R. R.*, office at South Bethlehem, Pa.

W. B. PAGE has been appointed superintendent of the *Interstate Public Service Co.*, office at Greenwood, Md.

As announced in the November issue of "Railway Engineering," JOHN A. DROEGE has been appointed general superintendent of the *New York, New Haven & Hartford R. R.* at New Haven, Conn. He entered railway service as telegrapher and stenographer with the B. & O. R. R., and was later employed by the C. & O. Ry., the N. & W. Ry. and the predecessors of the Southern Ry., advancing to train dispatcher, chief dispatcher, yardmaster and trainmaster. He accepted a position as assistant trainmaster on the L. V. Ry. in 1898, and was subsequently trainmaster and superintendent of terminals, and in 1904 was appointed superintendent of the Providence division. He entered the service of the New Haven Dec. 8, 1912, as superintendent of the Shore Line division. On Sept. 14, 1913, he was promoted to fill the newly created office of general superintendent.

C. E. BROOKS has been appointed acting superintendent of the Montana division of the *Oregon Short Line R. R.*, office at Pocatello, Ida., succeeding C. F. SMITH, granted leave of absence on account of ill health.

GEORGE WALLISER has been appointed superintendent of the Peoria & Pekin Union Ry., office at Peoria, Ill.

As announced in the November issue of "Railway Engineering" CLEMENT WILLIAM NELSON has been appointed assistant to president of the *St. Louis South Western Ry.*, office at St. Louis, Mo. He was born July 12, 1870, at Morristown, Ill., and educated in the public schools. He was employed by the American Express Co. on the G. N. Ry. in June, 1889, and from September, 1890, to September, 1896, was employed by the G. N. Ry. as clerk and timekeeper in various departments. In September, 1896, he was appointed chief clerk to superintendent, holding this position on vari-

ous divisions, and in July, 1899, he went with the St. L. S.-W. Ry. as chief clerk to the general superintendent. He was chief clerk to the vice president and general manager from March, 1900, to May 18, 1906, on which date he was appointed assistant general manager. His appointment as assistant to president was effective October 7, 1913.

C. R. PUTNAM has been appointed superintendent of the *Waukegan & Mississippi Valley Ry.* at Waukegan, Ill., succeeding J. W. SELLS.

B. A. PORTER has been appointed superintendent of the Memphis division of the *Yazoo & Mississippi Valley R. R.*, office at Memphis, Tenn., succeeding PATRICK LADEN, resigned.

Engineering

G. C. CLEAVER, formerly division engineer, has been appointed engineer maintenance of way of the *Buffalo, Rochester & Pittsburgh Ry.*, office at Rochester, N. Y. E. H. HAMMOND, formerly division engineer at Rochester, N. Y., has been appointed division engineer of divisions 3, 4, and 5, office at Du Bois, Pa., succeeding Mr. CLEAVER. J. P. REYNOLDS has been appointed division engineer at Rochester, N. Y., succeeding Mr. REYNOLDS.

J. CLIFFORD, formerly with the Illinois Central R. R. has been appointed assistant engineer maintenance of way of the *Canadian Pacific Ry.*, lines west, office at Winnipeg, Man. F. B. TAPLEY, formerly resident engineer, has been appointed assistant engineer maintenance of way, lines East, office at Montreal, Que. G. A. DELACHAROIS has been appointed resident engineer, Saskatchewan division, office at Saskatoon, Sask. He succeeds J. V. MCNAB, who has been appointed resident engineer, same division, at Moose Jaw, Sask. F. S. ROSSITER has been appointed resident engineer at London, Ont., succeeding Mr. TAPLEY.

F. T. BECKETT, Engineer Maintenance of Way
Chicago, Rock Island & Pacific Ry.

H. RETTINGHOUSE, Chief Engineer
Chicago, St. Paul, Minneapolis & Omaha Ry.

A. B. WARNER, vice president and general superintendent, has been appointed also chief engineer of the *Chicago, Rock Island & Gulf Ry.*, office at Ft. Worth, Tex., succeeding H. M. STONE, resigned.

F. T. BECKETT has been appointed engineer maintenance of way of the *Chicago, Rock Island & Pacific Ry.* at El Reno, Okla., succeeding T. W. FATHERSON. Mr. BECKETT was born Oct. 2, 1870, at Frankford, Kan., and graduated from Kakoko College in 1893, and from Valparaiso University in 1896. He entered the service of the A., T. & S. F. Ry. in November, 1897, and held successively the positions of chainman, rodman, transitman and inspector. On April 1, 1900, he went with the C., B. & Q. R. R. as assistant engineer on double track construction, and was later assigned to preliminary and location surveys. He returned to the Santa Fe as assistant engineer on construction, June 15, 1902. He was appointed assistant engineer in charge of maintenance work, Rio Grande division, Jan. 1, 1903. He was assigned to construction work Aug. 15, 1906, Western Oklahoma Ry., and to preliminary and location survey, A., T. & S. F. Ry., at Burro Mts., N. M., June 1, 1907. He was appointed resident engineer of the E. P. & S. W. System, March 1, 1908, in charge of maintenance and construction. His appointment as engineer maintenance of way, C., R. I. & P. Ry., was effective November 1.

As noted in the November issue of "Railway Engineering," C. W. JOHNSON has been appointed consulting engineer of the *Chicago, St. Paul, Minneapolis & Omaha Ry.*, St. Paul, Minn. He graduated from Union College, Schenectady, N. Y., in the class of 1866, with the degree of Civil Engineer. From 1867 to 1870 he was employed in the chief engineer's office, L. S. & M. S. Ry., on surveys for extensions of the C., R. I. & P. Ry.; 1872 to 1879 he was assistant and division engineer on construction, Wisconsin Central Ry. March 1, 1879, he was appointed chief engineer of the Chicago, St. Paul, Minneapolis Ry., holding the same position under the C., St. P., M. & O. Ry., its successor, till Nov. 1, 1913, the date of his appointment as consulting engineer.

As announced in the November issue of "Railway Engineering," H. RETTINGHOUSE has been appointed chief engineer of the *Chicago, St. Paul, Minneapolis & Omaha Ry.*, office at St. Paul, Minn. He was born in Germany, July 30, 1861, and was educated in Germany. He came to the United States in 1882 and began railway work in 1883 as rodman, Wisconsin Central Ry. In 1884 he was employed on the Milwaukee, Lake Shore & Western Ry., later absorbed by the C. & N. W. Ry., where he held successively the positions of leveler, transit man and assistant engineer on location maintenance and construction. He was city engineer of Ashland, Wis., for three years, and also in general engineering practice, 1893-1897. In the latter year he returned to the C. & N. W. Ry. as assistant engineer, construction and maintenance. In May, 1900, he was appointed superintendent of bridges and buildings, Ashland division. He returned to the Wisconsin Central Ry. as division engineer, and again to the C. & N. W. Ry. in January, 1907, as division engineer at Boone, Ia. He was appointed superintendent at Boone, Ia., in April 1912, which position he held at the time of his appointment November 1.

The *Cleveland, Cincinnati, Chicago & St. Louis Ry.* has substituted departmental for divisional organization, and C. A. PAQUETTE, formerly assistant chief engineer, has been appointed chief engineer maintenance of way, office at Cincinnati, O. He reports direct to the general manager, and has charge of all main-

tenance matters. The chief engineer will continue to handle all other engineering matters except maintenance of way and structures.

GEORGE H. BURGESS, chief engineer of the *Delaware & Hudson Co.*, has been appointed chairman of the valuation committee, office at Albany, N. Y. JAMES MACMARTIN, formerly assistant chief engineer, has been appointed chief engineer, office at Albany, N. Y. O. F. ROWLAND has been appointed assistant engineer at Albany, N. Y.

A. D. PARSONS has been appointed division engineer of the *Erie R. R.* at Susquehanna, Pa., succeeding O. F. BARNES, appointed trainmaster.

R. L. COOPER has been appointed chief engineer of the *Fort Dodge, Des Moines & Southern R. R.*, office at Boone, Ia. He entered the service of this road in 1906 and held successively the positions, rodman, instrument man and assistant engineer. He was employed as secretary and engineer of the Conn Construction Co., April 1, 1912, which position he held at the time of his appointment as chief engineer.

D. J. BRUMLEY, formerly engineer maintenance of way, has been appointed assistant chief engineer of the *Illinois Central R. R.*, office at Chicago, Ill. M. B. MORGAN, formerly roadmaster, has been appointed assistant engineer maintenance of way, office at Chicago, Ill.

A. MCCORMICK, division engineer of the *International & Great Northern Ry.*, has been transferred from Houston to Palestine, Tex.

C. L. WALLACE, formerly office engineer, has been appointed assistant chief engineer of the *Kansas City Southern Ry.*, office at Kansas City, Mo.

E. M. BASYE has been appointed division engineer of the *Kansas City Southern Ry.*, terminal division, in charge of all engineering and road department work, office at Kansas City, Mo. For the past year he has been assistant engineer of the same territory, in charge of engineering, the road department being under M. A. Box, general roadmaster.

G. H. BURGESS, Chairman Valuation Committee
Delaware & Hudson Co.

E. P. WEATHERLY has been appointed engineer maintenance of way of the *Kansas City Terminal Ry.*, office at Kansas City, Mo. He was born near Salisbury, Mo., in 1877, attended the University of Missouri, receiving a bachelor of arts degree in 1897, and a bachelor of science in civil engineering in 1899. He entered the service of the C., B. & Q. Ry. in 1899, as rodman at Hannibal, Mo.; was promoted to resident engineer at Brookfield, Mo., April, 1900; transferred as resident engineer at Hannibal, Mo., in April, 1901; promoted to division engineer, St. Joseph, Mo., in May, 1905; and promoted to engineer of construction at Marion, Ill., in charge of extension to the Ohio river, in July, 1909. On Jan. 1, 1911, he was appointed division engineer of the K. C. T. Ry., which position he held until Nov. 1, 1913, when he was made engineer of maintenance. This is a new position which has just been created to take care of extensive terminals which are almost completed. Mr. WEATHERLY is a member of the American Society of Civil Engineers and a member of the American Railway Engineering Association.

C. F. BURRELL has been appointed engineer and roadmaster of the *Kentucky & Indiana Terminal R. R.*, office at Louisville, Ky., succeeding to the duties of J. B. WILSON, engineer, and J. J. MCKENZIE, roadmaster, both resigned.

F. W. GILCREAST has been appointed engineer maintenance of way of the *Lehigh & New England R. R.*, succeeding C. W. Brown, promoted. The office of chief engineer has been abolished.

A. W. MAY, formerly in the masonry department, has been appointed assistant engineer of the *Louisville & Nashville R. R.* at Nashville, Tenn. He succeeds F. C. FLYNT, appointed assistant engineer at Louisville, Ky., maintenance of way department.

F. J. DEIMLING, formerly engineer of construction, has been appointed assistant chief engineer of the *Michigan Central R. R.*, office at Detroit, Mich. C. C. HILL, formerly division engineer, has been appointed engineer of construction, office at Detroit, Mich. F. B. MARBLE has been appointed division engineer at Niles, Mich., suceeding MR. HILL.

L. C. MARSHALL has been appointed assistant engineer of the *Missouri Pacific Ry.* at Poplar Bluff, Mo., succeeding L. WINSHIP, assistant engineer, transferred to the office of the assistant chief engineer, at St. Louis, Mo.

S. M. BATE has been appointed division engineer of the *New Orleans, Texas & Mexico R. R.* at De Quincy, La.

E. H. ZEIGLER has been appointed district engineer of the *Peoria & Eastern Ry.*, office at Cincinnati, O.

W. H. RUPP has been appointed chief engineer of the *Sumpter Valley Ry.* at Baker, Ore.

As announced in the November issue of "Railway Engineering," FRANK W. KANE has been appointed assistant chief engineer of the *Texas & Pacific Ry.* at Dallas, Tex. He entered the service of this railway as architect in 1905. He was later appointed office engineer, and then on October 1, assistant chief engineer. Previously, he was employed in the engineering and architectural departments of the M., K. & T. Ry., the M. P. Ry. and the A., T. & S. F. Ry. He has also been city engineer of Fort Worth, Tex., and Shreveport, La.

D. E. WOOZLEY has been appointed engineer maintenance of way of the *Union R. R.*, office at East Pittsburgh, Pa., succeeding W. S. GIBSON.

Bridges and Buildings.

H. MARSHALL has been appointed bridge and building master of the *Canadian Pacific Ry.* at Saskatoon, Sask., succeeding E. L. TAYLOR.

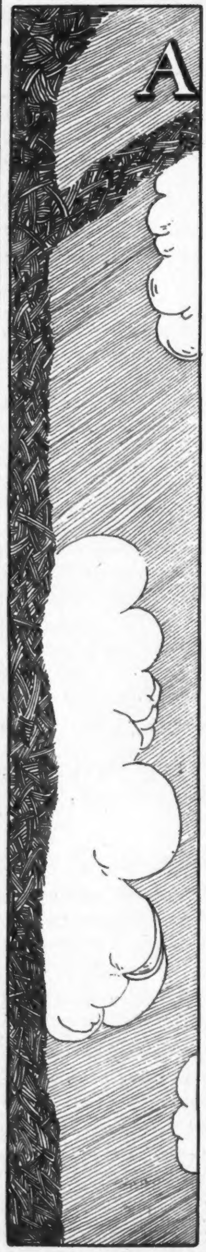
GEORGE WHEELER, general foreman of bridges and buildings, *International & Great Northern Ry.*, has been transferred from Taylor to Ft. Worth, Tex.

E. B. BRINK has been appointed supervisor of bridges and buildings of the *New York Central & Hudson River R. R.* at Rochester, N. Y., succeeding J. SCHAFFER, deceased.

J. M. COTHRAN has been appointed supervisor of bridges and buildings of the *Southern Ry.* at Charleston, S. C., succeeding H. S. DOUGLASS, resigned to engage in private business. J. B. TEALFORD, formerly at Princeton, Ind., has been appointed supervisor of bridges and buildings, Louisville division, office at Louisville, Ky. EDWARD VEITH has been appointed supervisor of bridges and buildings at Princeton, Ind., succeeding Mr. TEALFORD.

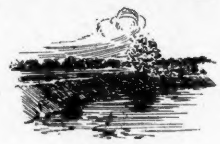
The Maryland & Pennsylvania has received bids for an addition to its passenger station at Baltimore, Md. This will cost about $60,000.

The Missouri, Kansas & Texas has applied for permission to build a bridge over the Mississippi river at Hannibal, Mo.

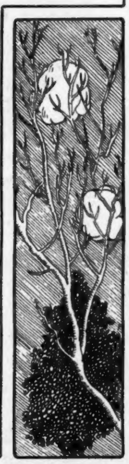


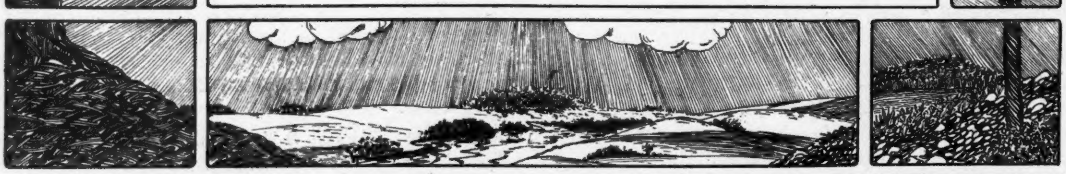
A Job for the Panama Gang

(FOR THE CLEVELAND LEADER)
by Mary Allen Keller
A.S.Gunn - Del.



Here in the valley of great tribulations,
The old Mississippi is waiting for you;
Save us from cruel and swift inundations;
Here's something nobody ever could do!
Keep back the waters from such a high score again;
Give us a basin with plumbings all new;
Floods, when they come, to be put into store again,
Ready to use at the turn of a screw.
Set back the great Mississippi in bonds again;
Turn your screw loose on submerged Arkansas;
Place back the farmers upon their own grounds again;
Eat up the drift with your great dredges maw.
Don't send us back to the floods and the fires again;
See we have toiled without hope years and years;
Flood-relief—Lord must we climb over wires again!
Haven't you something to stop fears and tears!
Is there a river that you cannot harness?
Is there a dam that you can't make secure?
Oh, for our waste and unwisdom don't scorn us;
Leave us no longer such woes to endure!
Come, cross the gulf with all your steam shovels;
Bring us the engines—yes,, all that remains of them;
Bring hope and courage and stay the flood troubles;
Bring the whole outfit—the men, and the brains of them.
Give us a land where we build in security;
Here where the homes of our forefathers sprang.
Give us assurance to reap in futurity—
Here's the next job for the Panama gang!





The Signal Department

THE POSSIBILITIES OF FLASH SIGNALLING IN BRITISH RAILWAY PRACTICE.

By J. F. Gairns.

The suggestion that flashing or occulting lights could be introduced into railway night signalling for the purpose of distinguishing and differentiating signals of particular classes is by no means new; but hitherto the proposal has not proceeded much beyond the academic stage by reason of the fact that the mechanisms to be used required development, and the need for them has not been sufficiently acute to call for the necessary preparatory work to render them reliable and trustworthy, nor has there been adequate occasion for investigating the practical problems associated with their use. A device is now, however, available—the "Aga" flashlight—derived from another branch of signalling, which appears to satisfy all practical requirements, and which possesses good features not included in other suggested flashing devices; and as there are decided possibilities of its actual introduction into British railway signalling, and good service has already been rendered by a number of installations in other countries, it is thought that a brief discussion of the conditions involved and probable adaptations will be in order.

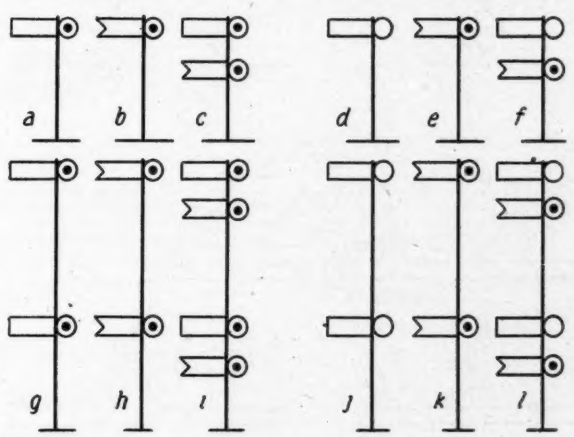


Figure 1.

Speaking generally, three more or less distinct proposals need to be considered. One is that all high speed signals, both stop and "distant," should be fitted with flashing lights by reason of the fact that they require to be seen a long way off and when travelling fast. Another is that all "distants" should be equipped with these lights, thus affording a means of distinguishing "distant" from "stop" signals at night, a problem which has not yet been adequately solved, though the use of yellow glasses, or lamps having illuminated fishtails, represent progress in that direction. The third proposal is that only high speed "distants," or "distants" applying to fast lines, should have flashing lights. Each course has its advantages, and its drawbacks, but the consensus of opinion appears to be in favor of the last suggestion, and with this view the writer is in agreement. It will, however, be instructive to consider what will be involved by all three proposals, especially as multi-track lines are common in Great Britain, and more or less elaborate signal complications are met with at intervals all over our railway system.

In order to indicate clearly what is involved, a series of sketches have been prepared setting forth representative conditions according to the respective policies; and further reference will be facilitated if these are studied. It must, however, be understood that the suggested signal and track conditions are varied to a larger extent than would be the case in practice, owing to the fact that on each railway a certain uniformity of methods is adopted. Moreover, signals of one direction only are included—except in one instance—to avoid confusion, but in practice, signals of opposite direction are often arranged on a single mast or bracket-post. In each case flashing lamps are indicated by a dot in a circle.

Figure 1 shows a selection of isolated signals such as occur on every main route where branch and siding signals are not required. *a, b, c* and *g, h, i* show what would occur if all high speed signals are fitted with flashing lights; *d, e, f* and *j, k, l* indicate the conditions when the "distants" only are so equipped. It is presumed that flashing lights would only be used for *all* high speed signals when clear of the crowded town areas, and out in the country, where high speeds are to be expected, there should be no difficulties unless two or more flashing lights are called for together. As regards *a* and *b*, all requirements as to distinctiveness at a distance would be complied with, and as no other lights are involved, the full advantages of the brightness of acetylene illumination can be realized if desired. But when a "distant" is carried on the same post, as at *c*, it is at once apparent that the double flashing involved is not commendable, especially as the two lights would then be separated only by a few feet. This is not, however, a serious drawback when signals are duplicated as at *g* and *h*, for on these high posts there would be at least twenty feet between the two lights, and frequently only one would be visible until the signal was neared. In fact, unless the vertical distance is considerable, there is no need for duplication in this way, so that any possible difficulty on this score remedies itself. At *i*, however, the evil is accentuated, for no fewer than four flashing lights would be involved. This is quite a common class of signal post in British practice, the posts being frequently fifty or more feet high; but flashing on this elaborate scale is not likely to meet with much favour. It may be that if all adjacent lights flash simultaneously and

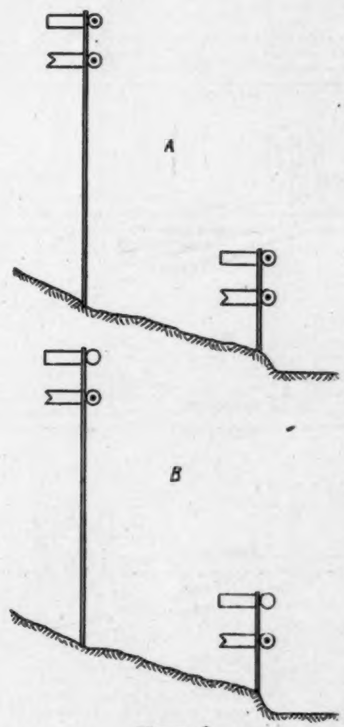


Figure 2.

synchronously, there would be no difficulty, but it will readily be understood that a series of lights flashing independently would be confusing.

At *d* and *j* steady lights suffice in accordance with the alternative practice, and in view of the fact that in high speed running the drivers go mainly by "distants" and all stop signals at danger are approached slowly, a steady light of ordinary brilliance is quite sufficient. For the distants, however, when on single isolated posts as at *e* and *k*, full advantages of the possibilities of flash lights can be taken and the more distinctive and the greater the distance of visibility the better. Moreover, the stop and distant signals are effectively differentiated. At *k*, the duplication by flashing lights, a considerable distance apart is quite satisfactory. At *f*, it has to be borne in mind that if the stop signal is at danger, the driver has already been forewarned, and at full speed, the "distant" is the essential signal. light, unless he missed the preceding "distant." Moreover, in the case of a post carrying both arms, the clear "distant" would be in itself an indication that he can go on, even if he missed the "stop" arm above it altogether.

Therefore, when only single series of signals are concerned, the problem is satisfactorily met if only the "distants" are fitted, and this policy provides a means of differentiating "distant" lights at night on a basis which presents advantages on the score of enhanced visibility at distance.

But when signals in combination are involved and on multitrack lines, the problems are not so easy of solution, and this is the crux of the matter. In Great Britain, few main lines proceed many miles without putting off branches or loops whose signals require to be displayed prominently and frequently to be repeated by "distants." Moreover, there are many hundreds of miles of track where three, four or more running lines are

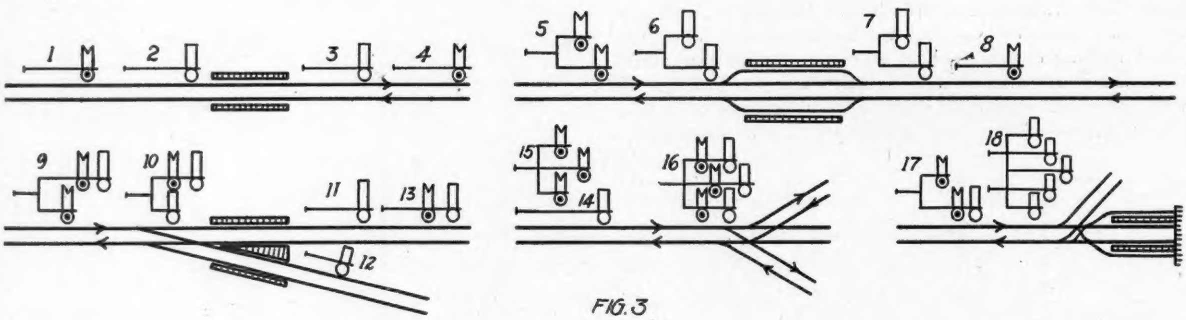


FIG. 3

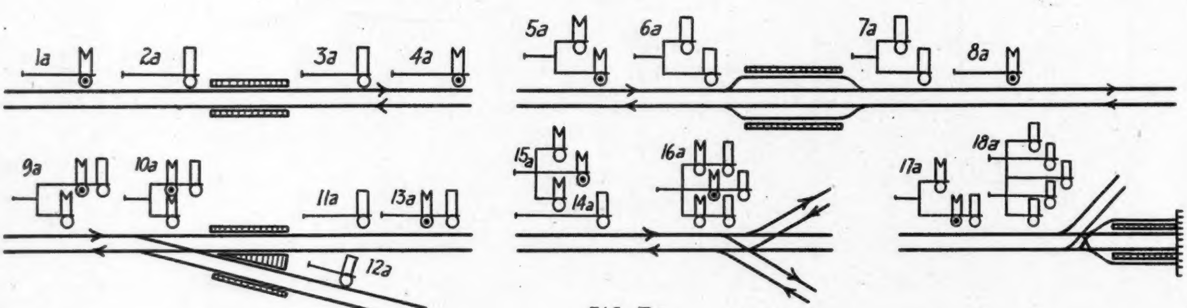


FIG 3a

Figure 3.

Therefore, any possibilities of confusion are largely discounted. In large measure the same remarks apply to *l*.

Figure 2 sets forth another class of signal erection to be found on many main lines, especially in cuttings and where a signal cannot easily be seen a long way off, unless an elevated post is fitted in one position, with a duplicate low down for nearer observation. These views also support the contention that the equipment of all high speed signals is not desirable and is likely to bring too many flashing lights into view simultaneously. Even the use of flashing lights for "distants" will frequently involve duplication, but with this policy there would always be a considerable separation distance. It may be suggested that it is unnecessary to fit a flashing light to the lower distant in a duplicated combination. But the policy of duplication should be properly maintained. Otherwise, there would be a suggestion that different signals were involved. It may also be argued that as a driver is supposed to know all his signals thoroughly, the fact that a flashing "distant" is placed under a steady "stop" light might tend to obscure the steady light above it and so hinder rapid identification. But if the two lights are suitably proportioned, this should not occur, and as already indicated, the "distant" is the principal signal during fast running and a driver could never cause trouble by failing to observe a "stop" placed abreast, so that there will often be two or more sets of signals applying to the same direction though referring to different lines.

Figures 3 and 3*a* set forth probable conditions on an ordinary two track main line, figure 3 showing conditions when all "distants" have flashing lights, and figure 3*a* the situation when direct line or high-speed "distants" are so equipped. It is unnecessary to cover the arrangement when all direct signals are fitted as in previous figures, but the two policies of 1° fitting all "distants," and 2° fitting only selected "distants" are here set forth. The former is desirable from the point of view that "distants" are effectively differentiated from "stop" arms, but as will be seen, this will result in combinations of flashing lights separated by a few feet only and under conditions where the visibility of all lights is likely to be a matter of importance. It will of course be understood that in this and subsequent diagrams, no account is taken of duplication of signals, nor of the varying locations which would be adopted in practice.

In figure 3, signals 1, 2, 3 and 4 are straight forward, but at 5 a double flashing "distant" is involved to give a forewarning of 6. At 9, another two-light flashing "distant" is involved in combination with a steady light, and at 10, there are two steady lights and one flashing "distant." In the case of

the triple junction controlled by 16, there are no fewer than three "distants" each under a steady stop light; and of these a forewarning is given by a triple "distant" bracket 15 in combination with a separate stop post 14. At the terminus at the top of the diagram, there are four arms for the respective platforms and one arm for a diverging goods branch outside; but only two "distant" lights are given at 17, one for the goods branch and one for the principal arrival platform at the terminus, the other platform signals not being repeated in this way. According to this policy therefore, signals 5, 9 and 17 would involve two flashing lights close together, and 15 and 16 would require three. This fact appears to be quite sufficient to prevent this proposition meeting with much favour; but the alternative suggestion in arbitrary distinction to meet the conditions of that particular junction.

So far, we have only considered the conditions of two track railways where the alternatives are: 1° flashing lights for all "distants," or 2° for direct route "distants" only. But when multiple track lines are involved, and a driver in one or both directions has in front of him two or more distinct sets of signals from which he has to pick out those which apply to the line he is traveling upon, three possible uses of flashing lights become involved. Therefore, in subsequent diagrams, we have to take account of: 1° flashing lights for all direct-line high-speed signals; 2° for all "distants;" and 3° for direct-line high-speed "distants" only.

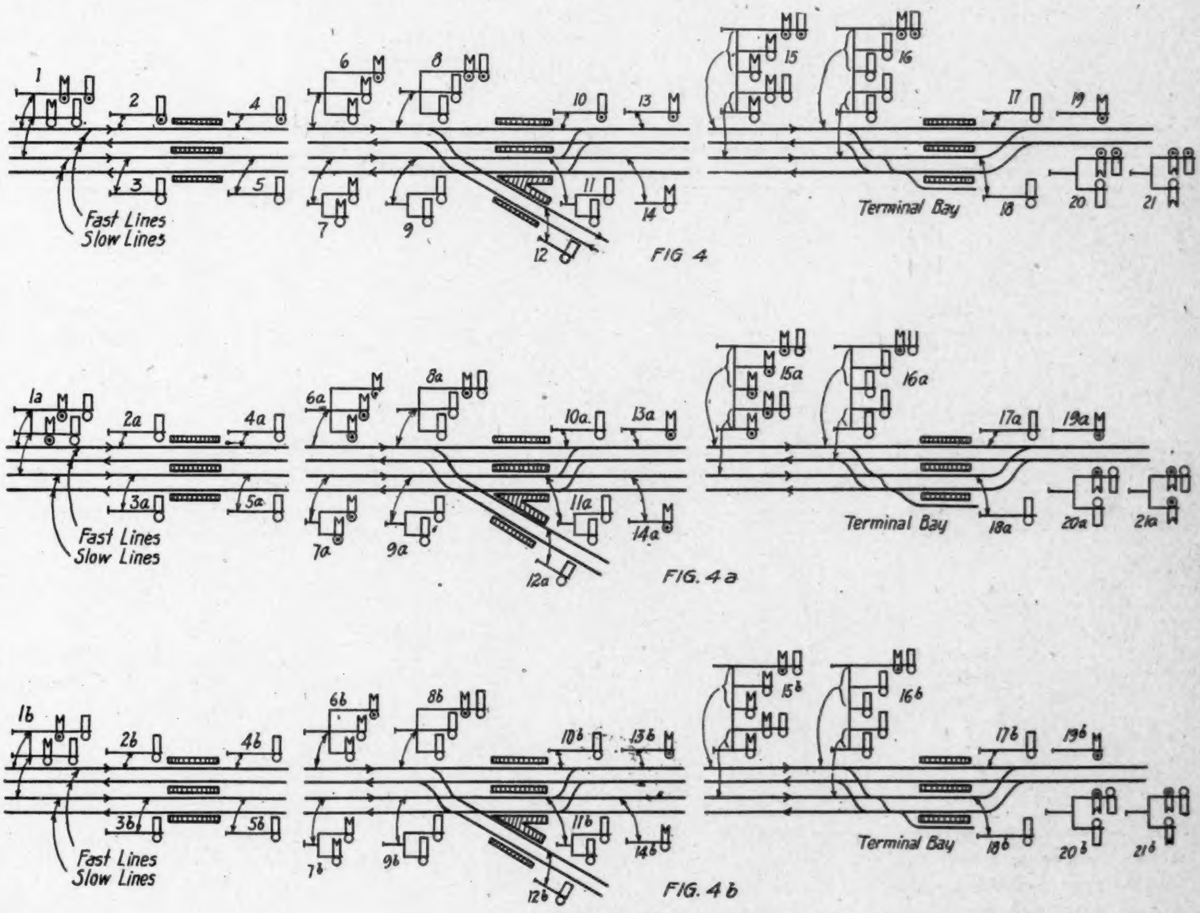


Figure 4.

figure 3*a* seems to meet all requirements. At 6*a*, it goes almost without saying that a train for the loop platform would not be allowed to take the points at full speed. Similarly at 10*a*, 15*a*, 16*a* and 17*a*, only the direct route is likely to be involved in high speed running. Therefore, it is sufficient to equip only the direct line signals with flashing lights, and signals 5*a*, 9*a*, 10*a*, 15*a*, 16*a* and 17*a* serve all requirements, though none of them has more than one flashing "distant" light.

The only possible condition where doubt may arise as to which "distant" shall flash is in the case of a bifurcating main line where each section is of equal importance. In such a case, signal 5 (fig. 3) would have both arms at the same level, and theoretically both should have flashing outfits. But in most instances, one section must have some superior claim, either by virtue of the straightness of track, suitability for high speed, or volume of traffic, and it can only be in very exceptional cases that this difficulty is a real one, while the remedy is to adopt an

Figure 4 shows a series of track diagrams for a double main line having the up and down lines in two distinct sets, one for fast traffic and the other for slow trains. At 1, though the signals for both down lines are carried on a duplex post, it is clear which apply to the fast line. Similarly, when the fast and slow posts are separated, as at 2 and 3 and other positions, it is also plain which track is involved; and along the fast line the crossover and branch signals are efficiently differentiated. Under such circumstances, a driver on a direct high-speed train has only to observe the flashing lights and can virtually ignore all others.

But against this must be set the fact that he has lost the distinction between "stop" and "distant" signals—in this respect, he is in the same position as under present conditions—and he is liable to get two or more flashing lights together as at 1 and 8.

The upper section of the figure involves the use of gantries to carry the complications involved by crossovers and a terminal

bay. But in the case of 15 and 16, the direct fast signals are clearly identified. Signals 21 and 20 cover the division of a two track main line into fast and slow tracks.

Taking the same track arrangements, but with flashing lights for all "distants," figure 4*a* shows how confusing the results are likely to be, particularly at 6*a* and 7*a* and at 15*a*. But when only direct fast line "distants" are fitted as in figure 4*b*, the whole difficulty is overcome, for in no single instance is there more than one flashing light, and throughout no doubt is involved as to which signals are thus distinguished. Indeed, as long as an express driver has all flashing lights clear, he hardly requires to take notice of other signals at all, and yet there are no confusing elements.

Figures 5, 5*a* and 5*b* indicate corresponding conditions on a four-track line with the fast lines in the centre, and with fast and slow lines of same direction alongside one another. In figure 5, the fast signals are clearly indicated, but frequently two flashing lights appear together. In figure 5*a*, the multiplication of flashing lights is likely to be most confusing; and in figure 5*b*, the restriction of flashing lights to direct high-speed distants overcomes all difficulties.

It will be seen from the foreging, that the suggestion that flashing lights should be used for all direct high-speed line signals is subject to the drawback that two or more adjacent flashing lights may be involved on a single post, or if signals are duplicated there may be four. To fit all "distants" is far too confusing on complicated sections to be entertained as a practical proposition. And we come back to the conclusion that the only practical use of flashing lights as a consistent feature of signalling is to confine them to direct high-speed main line "distants."

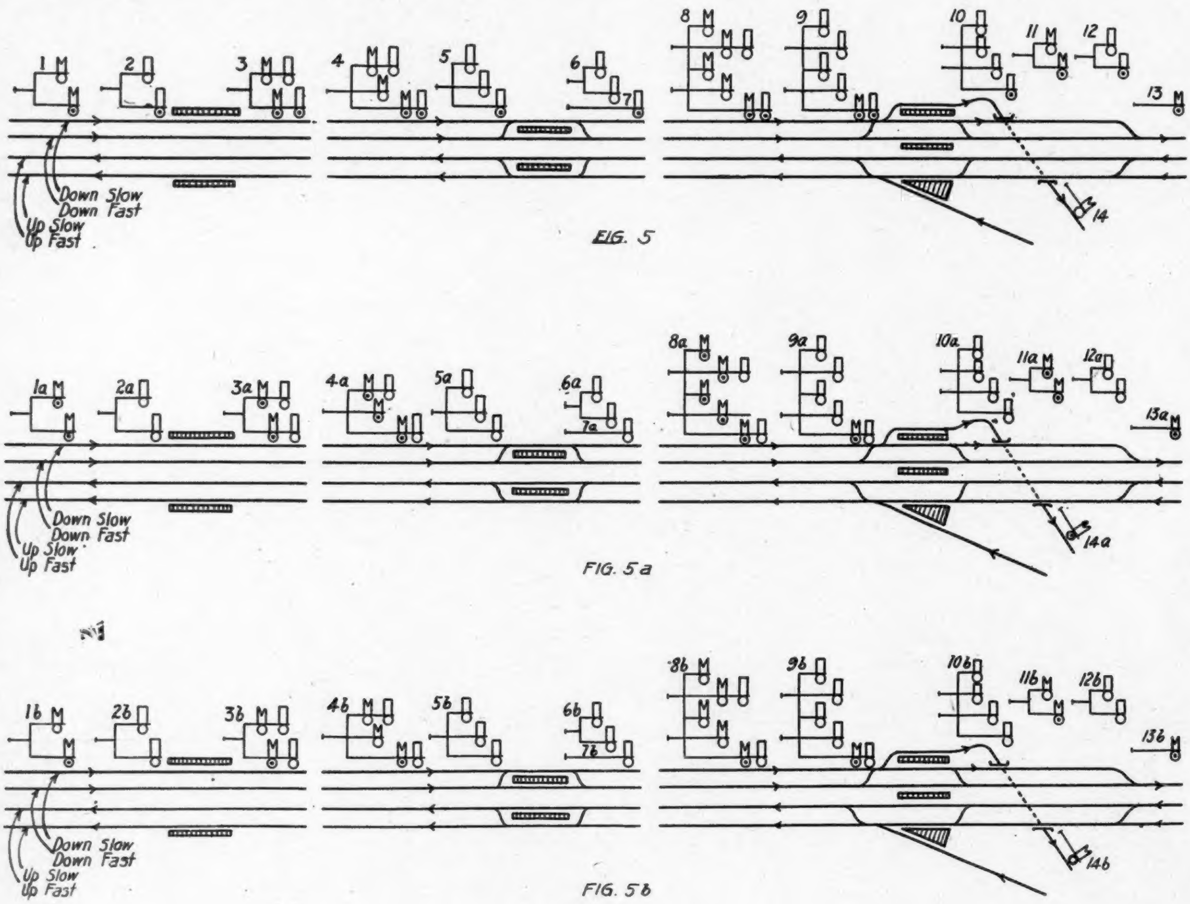


Figure 5.

Personals

Although we are publishing monthly in these columns a practically complete report of all appointments of interest to our readers, it is probable that this information could be published earlier if each subscriber would make it his business to notify us of new appointments immediately. We request and we shall appreciate your assistance in this respect.

A. B. KENDALL, formerly draftsman with the *Chicago & North-Western Ry.*, has resigned to go with the Hall Switch & Signal Co. at Garwood, N. J.

H. K. LOWRY, formerly assistant signal engineer, has been appointed principal assistant signal engineer of the *Chicago, Rock Island & Pacific Ry.*, office at Chicago, Ill. He graduated from the Massachusetts Institute of Technology in 1904, and entered the employ of the signal department of the C., M. & St. P. Ry., holding successively the positions of laborer, draftsman, inspector and assistant signal engineer. June 1, 1912, he went with the Rock Island as superintendent of construction, and Jan. 1, 1913, he was appointed assistant signal engineer, which position he held at the time of his promotion to principal assistant signal engineer.

C. F. STOLTZ has been appointed signal engineer of the *Cleveland, Cincinnati, Chicago & St. Louis Ry.*, office at Cincinnati, O., succeeding L. S. ROSE, assigned to other duties. A. J. KELLY has been appointed supervisor of signals and interlocking at Indianapolis, Ind., succeeding J. P. MCGILL, transferred.

H. L. KILIAN, formerly assistant signal supervisor, has been appointed supervisor of signals of the *Lake Shore & Michigan South-*

ern Ry. at Toledo, O., succeeding G. E. BECK, promoted to chief signal inspector, Cleveland, O. K. F. WAKEMAN, formerly signal inspector, has been appointed assistant supervisor of signals at Toledo, O., succeeding Mr. KILIAN. JAMES ANDERSON has been appointed signal inspector at Cleveland, O., succeeding Mr. WAKEMAN.

T. B. SMITH has been appointed supervisor of signals of the *Pennsylvania R. R.* at Sunbury, Pa.

J. E. STEWARD has been appointed signal engineer of the *Vandalia R. R.*, office at Pittsburgh, Pa.

A. J. KELLY, Supervisor Signals
Cleveland, Cincinnati, Chicago & St. Louis Ry.

W. W. Finley, president of the Southern Railway, died suddenly at his home at Washington, D. C., on November 25. His death was due to apoplexy.

G. E. BECK, Chief Signal Inspector
Lake Shore & Michigan Southern Ry.

Thomas M. Emerson, president of the Atlantic Coast Line, died at Wilmington, N. C., on November 25, following an attack of acute indigestion.

A. G. Machesney, for 15 years traveling engineer and locomotive inspector of the Baldwin Locomotive Works, Philadelphia, Pa., has accepted a position in the railway department of the Detroit Lubricator Company, Detroit, Mich.

Alexander A. Boutell, president of the Detroit Graphite Company, died at Atlantic City, N. J., on November 22, at the age of 73. Mr. Boutell had been ill for nearly a year.

J. H. Shugg, superintendent and engineer of winding, of the General Electric Company, with office at Schenectady, N. Y., has been made engineer of insulation of the Sterling Varnish Company, Pittsburgh, Pa.

Removal of Bulkheads in Concrete Work.

THE COMMON PRACTICE in concrete construction when stopping a day's work, is to set a wooden bulkhead in the forms (usually at mid span) to place the concrete against and prevent it from flowing under the bars in the section to be poured later.

It often happens that these bulkheads are not of sufficient height to extend to the top of slab or beam, and as a result the tops and side are covered with concrete, and are difficult to distinguish from the concrete. This means that when concreting is resumed, there is danger of such bulkheads not being removed unless the inspection and superintendence is the best. The chances of slab bulkheads not being removed are rather remote, the board being sure to show at some point even if covered to a certain extent by the overflow of concrete; but in beams and girders which are comparatively narrow, only the most rigid inspection will insure the removal of all boards used for bulkheads.

This point was forcibly impressed upon the writer a few days ago while inspecting some finished work done by reliable contractors under good inspection, where a wooden bulkhead in a narrow girder was left in the forms and concrete poured around it. Such occurrences serve to impress upon one the need of the best of inspection, for had this defect not been discovered in time the results might have been disastrous after the board had rotted out, with resultant weakening of the compression section of the girder.

Open Spandrels for Arch Bridges to Increase Flood Waterways.

ONE of the most serious objections to the use of concrete arch bridges for comparatively low level and narrow stream crossings is the restriction of waterway caused by this type of construction. At the crown of arch the waterway is as much greater than that at the springing line as the rise of the arch. This means that under flood conditions when the level of the water rises above the springing line of solid spandrel arches, the waterway becomes restricted and backing up of water with resulting damage and discharge "under head" follows.

If open spandrels are used the restriction of the waterway is very much less and in many cases the serious damage which would take place on account of backing up of water at solid spandrel arches, would be eliminated.

Where the spans are short or relatively short with small rise the gain in river prism may not be sufficient to justify the use of open arch spandrels. The open spandrels are more economical for arch bridges of considerable rise but for arches of small rise the cost will be greater than for solid spandrel arches. The question as to whether open spandrels should be used in any given case is one which merits the most careful study, for in many cases the saving resulting from the elimination of flood damage, by their use, will offset, many times, the extra cost of construction if any, involved.

Pressure Exerted By Wet Concrete.

SOME tests recently made by the Aberthaw Construction Co., Boston, Mass., show the pressure exerted by green concrete in long forms for spirally reinforced columns to be very nearly equal to that of a perfect fluid.

The pressures in the lower part of columns were not quite equivalent to full fluid pressure on account of the setting up of the first concrete poured. For example, with a mixture weighing 149 lbs. per cu. ft. the equivalent hydraulic pressure for a head of 2¾ ft. was 148 lbs. per cu. ft., while for a head of 17¾ ft. it was only 138 lbs. per cu. ft.; this height of concrete having been poured in 14 minutes.

This information, although in line with the assumptions generally made in designing forms for concrete work, establishes more convincingly than ever the necessity of using equivalent fluid pressures in the design of column and wall forms.

Announcement Extraordinary — Another Scoop

The January issue of "Railway Engineering" (Concrete Department) will contain an illustrated, detail description of the design and construction of a large reinforced concrete viaduct in the Middle West, concerning which nothing has been published in the technical journals. Besides this, an original article of a similar nature on a European structure of unprecedented size will be presented to our readers.

This is in line with our policy to make our Concrete Department the best in the field and the exponent of *original articles* on *up-to-date* concrete design and construction, which contain data of real value to the engineer and not merely popular descriptions so prevalent today.

CONCRETE FENCES IN ST. LOUIS.

Some concrete fences recently erected in St. Louis are of a combination shop and field built type. The posts, 6x8 inches above ground and 12 inches square below ground, were made in a shop. They were from 9 to 10 ft. high, the portion under ground being 3 ft. long. The posts were then erected about 6 to 9 ft. centers, and five ½ in. dia. horizontal bars placed in holes in the posts at a uniform vertical spacing, to serve as main panel reinforcing. These bars reach only from center to center of posts, so as to provide, in a measure for expansion and contraction of the concrete. Vertical rods $\frac{5}{16}$ in. in dia., are tied to the horizontal bars at intervals of about a foot. Solid concrete panels 4 in. thick were then cast between the posts. The panels were scrubbed with wire brushes as soon as forms could be removed, while the posts have a troweled finish.

CURRENT PRICES—CONCRETE MATERIALS.

Portland Cement—The demand is somewhat lighter than it was a year ago and shipments have fallen off to some extent. Indications for next year, however, are improving and a good demand is expected. Prices given are f. o. b. cars at points named including cloth sacks, for which, in general 40 cents per barrel is refunded on return in good condition. Prices per barrel are as follows: Boston, $1.72; New York, $1.58; Pittsburgh, $1.55; New Orleans, $1.78 on dock; Memphis, $1.84; Cleveland, $1.70; Detroit, $1.69; Indianapolis, $1.70; Toledo, $1.69; Peoria, $1.69; St. Louis, $1.55; Chicago, $1.55 to $1.60; Milwaukee, $1.64; Minneapolis and St. Paul, $1.75 to $1.80; Montreal, $1.75 to $1.80; Toronto, $1.95; Winnipeg, $2.40 to $2.50; Kansas City, $1.59; Omaha, $1.78; Portland, Ore., $2.20; Spokane, $2.40; Seattle, $2.20.

Crushed stone—1½ in. stone, prices per cubic yard, f. o. b. cars in car load lots unless otherwise mentioned. Boston 80c at quarry; New York, 85c to 95c, full cargo lots; Chicago, $1.15 in car load lots; Toronto, 70c to 75c per ton at quarries; Spokane, $1.25; Seattle, $1.50.

Gravel—Prices given are per cubic yard f. o. b. cars in car load lots unless otherwise mentioned. Boston, 75c; New York, 85c to 95c in full cargo lots at docks; Chicago, $1.15; Portland, Ore., $1.00; Spokane, $1.38; Seattle, $1.10.

Sand—Prices per cubic yard, f. o. b. cars, in car load lots unless otherwise indicated. New York, 50c full cargo lots at docks; Chicago, $1.15; Toronto, $1.15; Portland, Ore., $1.00; Spokane, $1.00; Seattle $1.10.

Reinforcing Bars—Business is very dull in all districts and prices have fallen off somewhat since last month. Pittsburgh bases quotations on mill shipments, f. o. b., are $1.40 per lb., on large orders, although quotations of $1.35 can be obtained; with the prevailing extras for bars nude ¾ inch or base. The following are quotations on base bars for mill shipment from other points f. o. b. cars: Chicago, $1.53 to $1.58 per lb.; Portland, Ore., $2.20; Spokane, $2.26; Seattle, $2.25. Shipments from stock are being made at the following prices, f. o. b. cars. Pittsburgh, $1.85; New York, $2.25; Cleveland, $1.85; Cincinnati, $1.85 to $2.00; Chicago, $1.95 to $2.00; Montreal, $2.15; Toronto, $2.25; Winnipeg, $2.50; Portland, Ore., $2.40; Seattle, $2.25; Spokane, $3.00.

Metal Clips for Supporting Bars—$7.25 to $8.00 per 1,000 depending on size.

For the majority of the prices given we are indebted to the Universal Portland Cement Co., Sandusky Cement Co., Concrete Steel Co., Chicago, and F. T. Crowe & Co., of Seattle, Portland, Spokane.

Reinforcing bars for mill shipment are in general sold on a Pittsburgh basis; that is, at the Pittsburgh quotation plus the freight to the point in question. With the following list of freight rates on finished material and the Pittsburgh quotation given the price of bars at any of the points listed can be readily computed.

FREIGHT RATES, FINISHED MATERIAL.

From Pittsburgh, carloads, per 100 pounds to:—

New York	16	cents
Philadelphia	15	cents
Boston	18	cents
Buffalo	11	cents
Cleveland	10	cents
Cincinnati	15	cents
Chicago	18	cents
Denver	84½	cents
St. Louis	22½	cents
New Orleans	30	cents
Birmingham	45	cents

RAILWAY ENGINEERING AND MAINTENANCE OF WAY

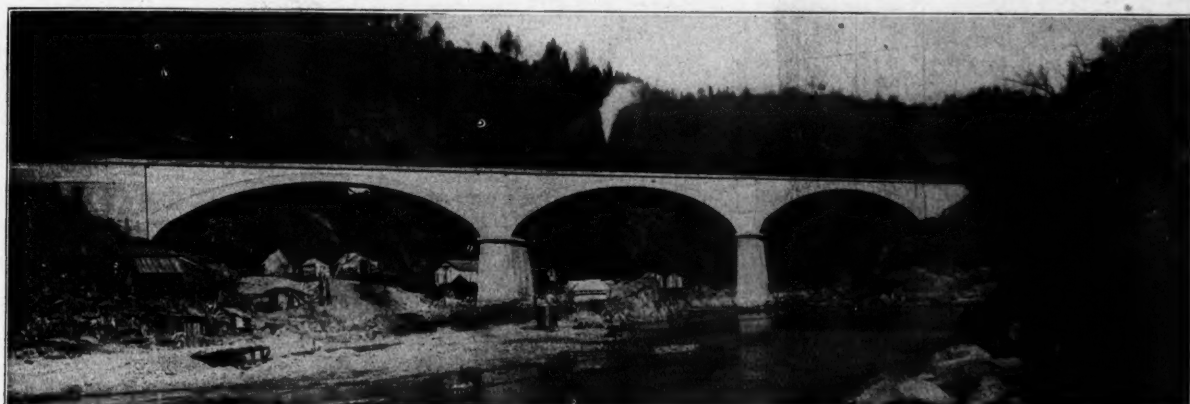
American River Bridge

Three Arch Solid Spandrel Bridge of the Mountain Quarries Co., near Auburn, California.

By A. M. Wolf, C. E.

General.

Among the long span reinforced concrete railroad bridges recently built is the American River Bridge at Auburn, California, built in 1912 for the Mountain Quarries Co. This structure, a single track bridge is 482 ft. long (not including approaches), 15 ft wide and about 70 ft. high, consisting of three 140 ft., solid barrel skew arch spans. The arch rings of reinforced concrete with a crown thickness of 3 ft. 3 in. have solid spandrel walls also of reinforced concrete retaining the earth fill and ballast. The rough and precipitous nature of the banks of the stream necessitated locating both approaches on 16 degree curves and placing the piers and abutments at a skew of 45 degrees with the center line of the bridge. The traffic over the structure is exceedingly heavy, the bridge having been built to give access to the stone quarries across the river, from which many trainloads of stone are taken daily. The bridge bears the unique distinction of being the longest span concrete arch bridge for railroad traffic, owned by private capital.



American River Arch Bridge, Auburn, Cal.

Economic and Esthetic Considerations.

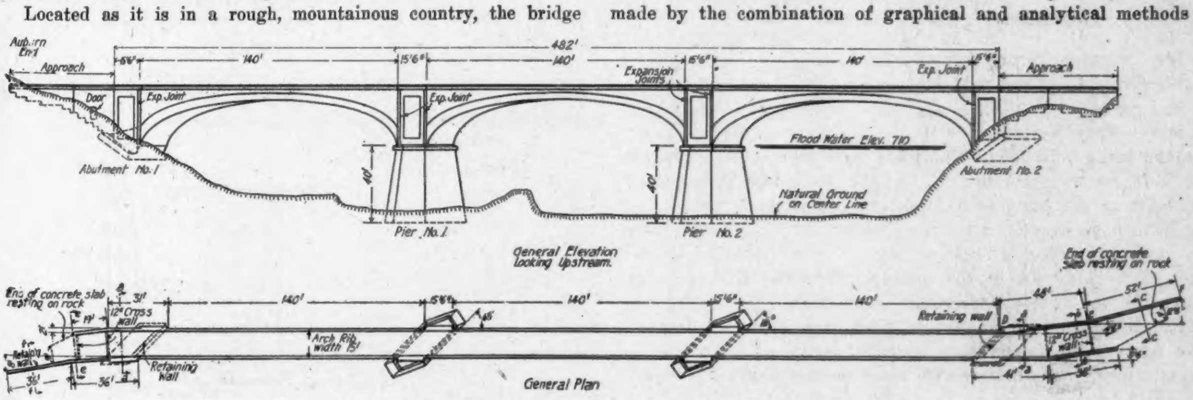
The design for the reinforced concrete arch structure illustrated and described here was submitted to bidders in competition with a structural steel design and it is interesting to note that the bids on the former were 20 per cent lower than those on the steel design. This, needless to say, along with the other advantages to be gained, led to the adoption of the reinforced concrete design.

Located as it is in a rough, mountainous country, the bridge on account of its plain, but massive and graceful outlines harmonizes with its surroundings in a most pleasing manner. The many-centered arch rings have a fine appearance as well as being economical. The solid spandrels give the bridge an added degree of massiveness and stability such as is required in a structure crossing a stream subject to torrential floods.

Design.

The live load used in the design and analysis of stresses in the arch rings was Cooper's E-52 loading, heavy Mallet locomotives being used to haul trains on this road. For this loading an equivalent uniform live load, plus 50 per cent impact, was computed and found to be 650 lbs. per square foot. This was increased to 700 lbs. per square foot in the designing computations. The dead loads used were: Concrete 150 lbs. and earth fill 120 lbs. per cubic foot. In addition to the stresses caused by these loads the stresses due to a variation in temperature of 20 deg. F. each way from the normal and also those due to rib shortening were considered.

The arches were designed as many centered, the thrust lines lying within the middle third for all stresses produced by dead load plus partial live load (so placed as to produce the greatest bending in the rib), as is shown in Figures 1 and 2 which give the graphical and analytical calculations. This means that for dead and partial live loads the arch is designed as a plain concrete structure, the reinforcing being necessary only to care for temperature and rib shortening stresses combined with the dead and live load. The arch ring analysis was made by the combination of graphical and analytical methods



Plan and Elevation, American River Bridge.

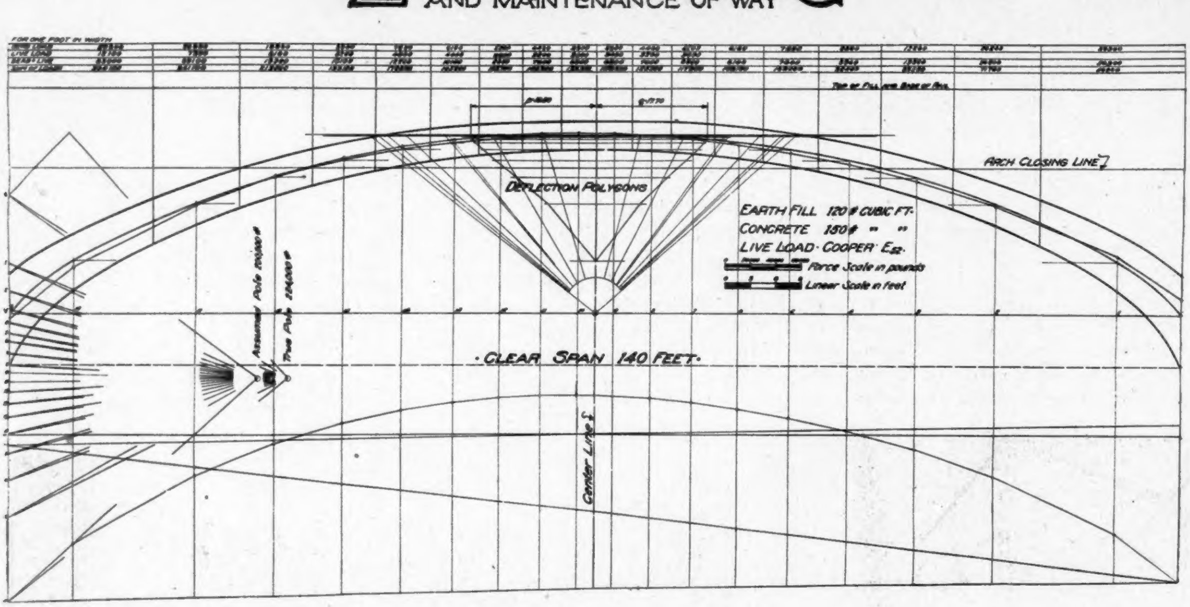


Fig. 1. Force and Deflection Polygons for Arch Ring.

based on the elastic theory. As is shown by the table (Fig. 2) the maximum compression in the concrete for dead load and partial live load is 644 lbs. per sq. in. at the extrados of the section at the springing line. The maximum combined compressive stress considering also temperature and rib shortening stresses is 1051 lbs. per sq. in. for the section next to the crown. The maximum tensile stress for combined stresses is 345 lbs. for the second section above the springing line. Figure 2 gives the various assumptions as to amount of reinforcing steel, location of same, etc. The high calculated stress, viz.: 1051 lbs. is justified by the facts that: The arches are reinforced; the ballast will cushion and reduce the impact to a lower figure than that assumed especially since the line load is only a small part of the total load; and that the assumed temperature variation will probably never take place in all parts of the ring.

Details of Design.

Arch Rings.—The arches, with a clear span of 140 ft. and a rise of 24 ft. have a crown thickness of 3 ft. 3 in. and a vertical thickness of 10 ft. at the springing line, the depth of the arch ring at the various sections between these points is shown in the accompanying diagram. (Fig. 3). The main reinforcement in the intrados near spring consists of 1¼ in. sq. bars 30 ft. long spaced 6 inches centers, extending well into the abutments and piers; beyond these are 1 in. sq. bars 30 ft. long, 6 in. centers lapping about 3 ft with the 1¼ in. bars and the ⅞ in. sq. bars 12 in. centers in the crown section. The same method

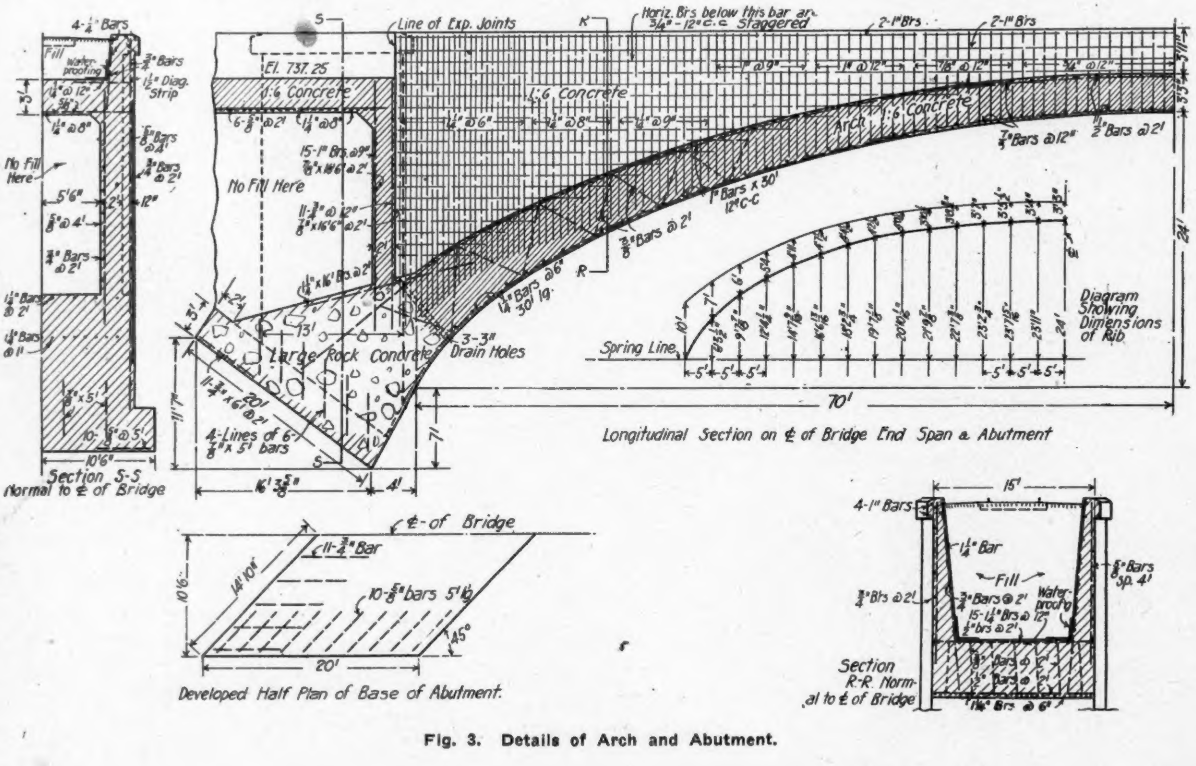


Fig. 3. Details of Arch and Abutment.

of reinforcing is used in the extrados but the spacing of the bars is twice that of bars in intrados. The main bars are placed about 3 in. clear from surface of concrete. Transverse reinforcing is provided in both top and bottom of ring by ½ in. bars spaced 2 ft. centers throughout. In the lower half of the arch ⅝ in. bars bent triangularly from top to bottom of ring extending longitudinally, spaced 2 ft. centers, tie the two planes of reinforcing together. At the junction of arch with abutment extra bars (1¼ in. x 16 ft.) are placed parallel to back of abutment and extend into the arch ring.

Abutments.—The abutments with footings 20 ft. by 29 ft. 8 in. in plan and 3 ft. thick are of plain concrete except for a few bars in the bottom edges of footing course to reinforce the 2 ft. projections beyond the abutment proper at sides and back. The footings are founded on solid rock and the bottoms are perpendicular to slope of intrados at the springing. The back of the abutment has a much flatter slope than the back of arch ring at the intersection of the two.

Piers.—The piers on a 45 degree skew with the center line of arches are of solid plain concrete, resting on bed rock a few feet below the stream bed. The top width at right angles to the axis of pier is 10 ft. 11½ in. under the coping which projects 1 ft. 3 in. The bottom width is 15 ft. 6 in., due to the constant batter of the faces, while the length of piers at bottom is 49 ft. 6 in. A skewed cutwater extending up to the coping is placed at each end of the pier. The coping is 2 ft. thick with a 6 in. bevel to the edge at the top. The total height of piers to springing line is 40 ft. (See Figure 4).

Spandrels.—The spandrel walls have a top width of 1 ft. under the coping 21 inches deep, which projects 6 in. The face of walls are vertical while the backs have a constant batter such that they are 1 ft. thick at the top and 3 ft. at the deepest part 10 ft. above the springing line. The coping is reinforced with four 1 in. horizontal bars, two near the top and two near bottom, below this the horizontal bars are ¾ in., spaced 12 in. centers staggered, in the face and back of wall. Vertical bars of size and spacing depending

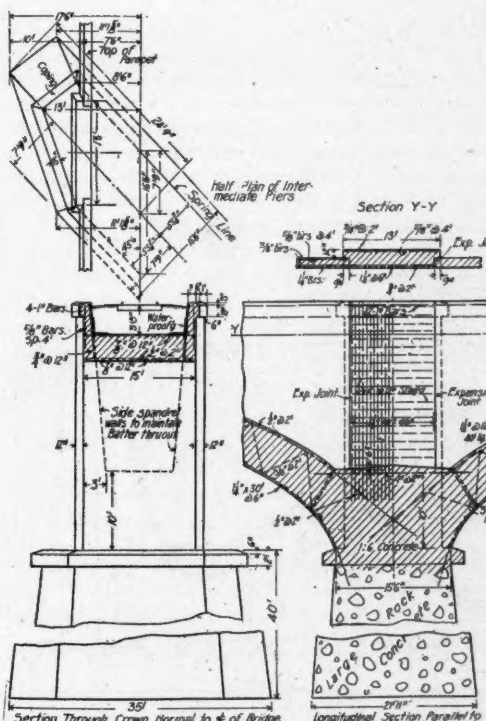


Fig. 4. Details of Piers.

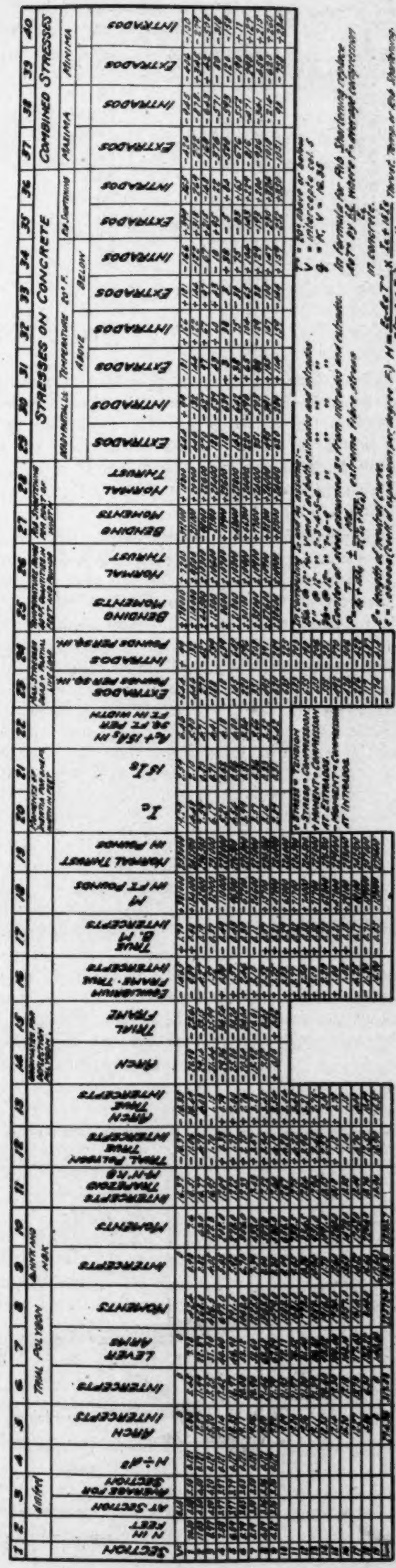


Fig. 2. Stresses in Arch Rings.

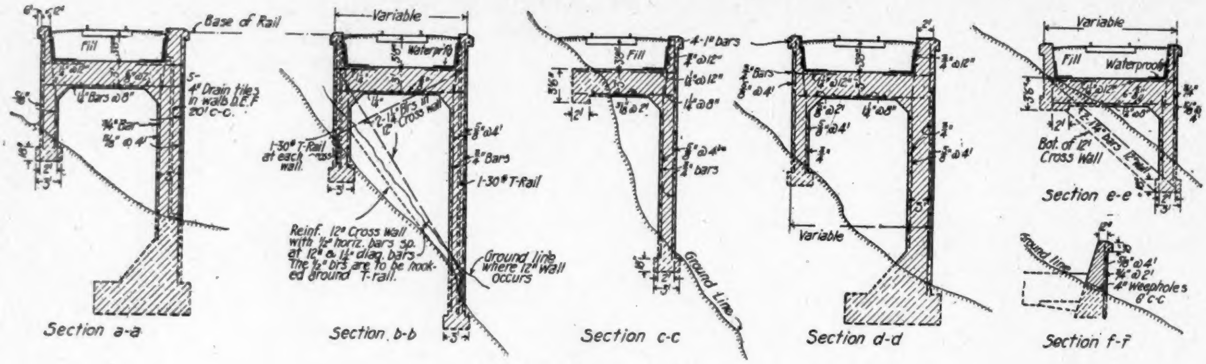


Fig. 5. Details of Approaches.

on height of wall as shown on longitudinal section of arch are placed in face and back of wall. The bars in the back extend from 3 to 4 ft. into the arch ring to give proper anchorage since the wall acts as a cantilever. At the junction of the spandrel with the back of the arch ring is placed a 1½ in. triangular coursing groove to emphasize the arch ring and hide the construction joint.

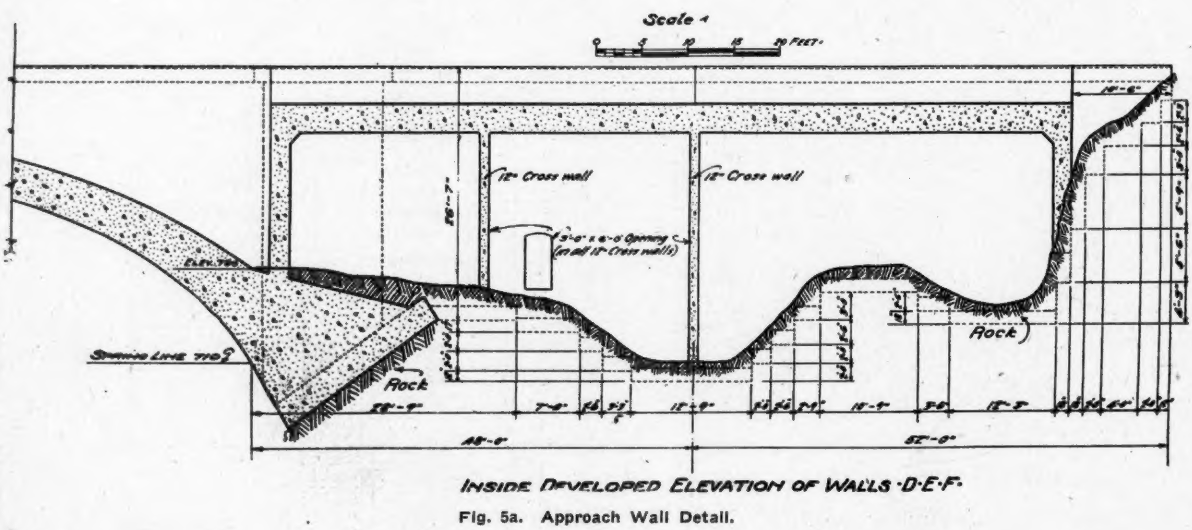
Over piers and abutments the spandrel wall is made 1 ft. thicker for a length of 13 ft. at the face to form a projecting pilaster with an inset panel. The back of this portion slopes the same as the rest of the spandrel wall. The reinforcing consists of 1¼ in. bars vertical at 6 in. centers in back and ⅝ in. 4 ft. centers in face with ¾ in. bars horizontal 12 in. centers staggered in both faces. These walls are 21 ft. high over the haunch backing of the arches. The spandrel walls are entirely separated from these pilasters by vertical expansion joints, the pilasters projecting over the ends of spandrels so as to hide the joint. A membrane waterproofing is placed at the junction of back of spandrel walls with the arch rings. The spandrels are 3 ft. 11 in. high at crown of arches while the spandrel fill is 3 ft. 8 in. deep at this point. Three 3 in. drain holes are placed at each side of piers and over abutments to drain the fill.

Approaches.—The approaches at either end consist of heavy reinforced concrete slabs carried on longitudinal walls also of reinforced concrete which follow very closely the curve of the track at the approaches in order to keep the span of slab to a minimum. The fill over these slabs is the same as at the crown of arches and the spandrel walls are also the same.

The approach at the quarry end of the bridge (right end in illustration) is considerably longer than the one at the Auburn end, as is shown in the plan. At points where breaks occur in the alignment of the longitudinal walls, cross-walls 1 ft. thick, extend from one side to the other. This necessitates two inner cross-walls in each approach not counting the cross retaining walls over abutments. These latter walls are 2 ft. thick, reinforced with ¾ in. bars 12 in. center in the bridge side face and 1 in. bars 9 in. centers in the other, well doweled into abutments, ⅞ in. bars are placed horizontal on 2 ft. centers in both faces.

The longitudinal bearing walls of varying height are 2 ft. thick with a 3 ft. footing course 1 ft. 6 in. deep. They are reinforced with ⅝ in. vertical bars at 4 ft. centers in both faces and ¾ in. horizontal bars 1 ft. centers staggered in both faces. Eighteen inch 45 degree fillets are placed at connection of side walls with deck slabs. At all cross-wall connections one 30-lb. T-rail is placed, around which are hooked the ½ in. horizontal bars in the cross-wall, spaced 1 ft. centers. These cross walls rest on a steep slope and as an extra precaution two 1¼ in. bars are placed diagonally each way, as shown in Section B-B., Figure 5, to tie the side walls together. To allow the removal of the inner forms the higher longitudinal wall at each end and all the inner cross-walls have a 3 ft. by 6 ft. opening in them as shown in the details.

The deck slabs with an average span of 12 ft., are 3 ft. thick reinforced with 1¼ in. bars, 8 in. centers transversely in bottom, with 1¼ in bars 5 ft. long, 12 in. on centers over the supports to care for negative moments. Above the main bars in bottom are ⅝ in. longitudinal distributing bars spaced 2 ft. apart. Where the slope becomes so steep that one sidewall can be omitted and also at ends where slab intersects the ground line, the slabs are rested directly on the solid rock. The na-



INSIDE DEVELOPED ELEVATION OF WALLS ·D·E·F·

Fig. 5a. Approach Wall Detail.

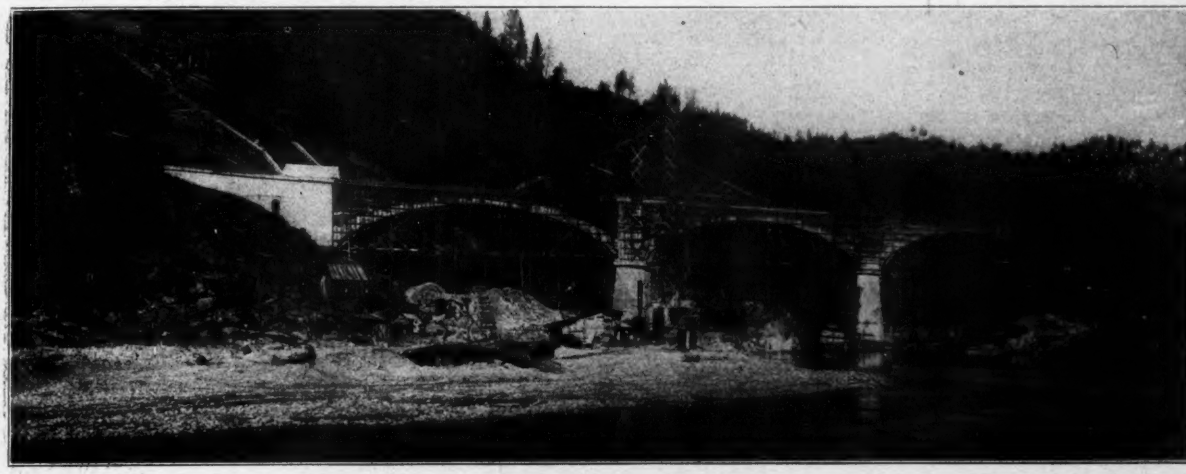
ture of the slopes makes a short retaining wall necessary at each end of the bridge, on opposite sides. These walls have a coping the same as spandrel walls, a vertical face and a back batter of 3¾ in. per foot, with ⅝ in. bars vertical at 4 ft. spacing and ¾ in. horizontal bars, 2 ft. centers.

The tops of all approach slabs are inclined 2 inches toward the longer longitudinal wall to provide for drainage. At the east end, five 4 in. dia. vertical drain tile lines approximately 20 ft. centers, set in the longitudinal walls, carry off the seepage. At the Auburn or west end, three such drains are placed. The approaches are waterproofed in same manner as the arches.

Concrete.—The concrete used for all reinforced work such as arch rings, spandrels and approach slabs was of a 1 to 6 mixture of gravel concrete. This same class of concrete was used in the abutments with large rock embedded. In the piers a 1 to 9 concrete, with large rock embedded, was used. The approach bearing walls are of 1 to 8 mixture.

Construction.

Centering.—The centering for the arch forms was of the framed bent timber trestle type, consisting of 8x8 in. posts, three to a bent, with bents 7 ft. 6 in. centers. The bents for two spans were founded on mud sills, while the bents for the arch at the east end were set on piles and braced with struts designed to take the thrust from the other arches, should the centering be carried out from under the other spans by a flood. This centering was heavily braced to the solid rock banks and also held by heavy cables fastened to anchors grouted in the solid rock. The danger of sudden torrential floods made these precautions necessary. All bents were rigidly sway braced and double cross-braced to one another. The accompanying illustration shows quite clearly the details of centering and construction plant.



Construction View, American River Bridge.

The lagging for the arch rings was laid on ribs formed by springing pieces of 2x4 timbers to the proper curve, thereby saving considerable expense which is usually incurred by sawing the ribs to the correct curvature. Near the haunches where the curvature is comparatively sharp, 2x4's could not readily be used and two pieces of 1x6 in. boards were used instead, for each rib.

Concreting.—The concrete after being mixed was hoisted in a tower, near pier No. 1 and then discharged through fixed chutes to a point near the crown of either of the two west arches as desired, from whence it was hauled to other parts of the structure in carts.

Comment.

This structure is an excellent example of heavy concrete design and contains many interesting and well worked-out details, as a study of the plans will show. We are indebted to Mr. John B. Leonard, of the firm of Leonard and Day, consulting engineers, San Francisco, Cal., the designer of the structure, for plans, photographs and data used in this article.

New Books

INSKIPS TABLES. Fourth edition, enlarged. Flexible leather, 5x7 in.; 600 pages, illustrated. Published by G. D. Inskip, 6728 Leeds St., Philadelphia. Price $3.00 postpaid.

The fourth edition of this popular set of tables contains several new features which increase its field of usefulness among draftsmen and designing engineers. The use of projecting thumb indexes for every fifth foot in the table of square and logarithms of feet and inches, the use of a good grade of bond paper of light weight reducing the thickness without impairing the wearing qualities, and the printing of the first eight pages of tables of squares and logarithms on linen are changes in the physical make-up of the book which cannot be too highly commended. In all such books of tables the first few pages are used much more than the others and are worn out or badly patched before the remainder of the book shows signs of excessive use, for this reason the use of linen for the first few pages will be very favorably received by all concerned.

Among the new features are: Mathematical and graphic solutions for hip and valley framing; table of pitches per foot run with their logarithmic function and angle, table of polygons to 150 sides with their logarithms, and table for spacing.

The general arrangement of tables in groups of four lines with a space between and the topography are excellent, making them exceptionally easy to follow and consequently far more restive to the eye than similar tables where the grouping feature is omitted and all lines on the page are spaced uniformly. Mr. Inskip's work has reached a high standard of accuracy and efficiency and is invaluable to the draftsman and designer.

THE GRAPHIC METHOD BY INFLUENCE LINES FOR BRIDGES AND ROOFS. By Wm. H. Burr and Myron S. Falk. Third edition, revised. Cloth, 6x9 inches; 275 pages, numerous text figures, 4 folding plates. Pub. by John Wiley & Sons, New York. Price $3.00.

The method of computing stresses in trusses and bridges by the use of influence lines is rapidly gaining popularity on account of its simplicity and ease of application to all forms of framed structures. As a labor and time saving device in making computations in structural work, this simple and universal

system of analysis is especially commendable, since it involves no higher mathematics. The graphical method of finding deflections as described in chapter V is extremely simple and much easier than the algebraic method.

Chapter I treats of the general principles of graphic statics and its application to roof trusses. In this chapter several pages have been entirely rewritten, giving a complete and accurate treatment of the bending stresses in the supporting columns of roofs. The methods set forth are simple and can easily be used in the practical operations of design. Influence lines for simply supported bridge trusses are next taken up. In this chapter the adaptation of influence lines to a great variety of problems is discussed with many practical examples. The solution of stresses in three-hinged arches and cantilevers by the method of influence lines is treated in an interesting manner in two chapters. Chapter 5 on the deformation of trusses as determined by the graphical method of the displacement or Williot diagram when the stresses in the members are known, shows very clearly the value of graphics for solving such problems. The value of the book is increased by chapter 6, which gives the detailed design of a pin connected railroad bridge, the stresses in the various members being determined by the methods given in the first part of the book. In its present makeup the book is invaluable to both the student and the designer.

TUNNELING. By Charles Prelini, C. E. Sixth edition, revised and enlarged. Cloth, 6x9 inches. 349 pages. 167 illustrations. Published by D. Van Nostrand Co., New York. Price $3.00 net.

No one can deny that the art of tunneling through various soils, and especially subaqueous tunneling, has advanced very rapidly within the last few years. For this reason the revised edition of this well-known book should prove especially interesting and valuable to the engineer and constructor engaged in such work. A few years ago submarine tunneling was undertaken with some hesitation, but today, due to the great amount of experience acquired, such difficult work is entered into without the least fear or hesitation. The purpose of this sixth edition is to present the subject in such a manner as to give due prominence to the most recent methods, many of which have been evolved within the last few years. That this purpose is fulfilled would be putting it mildly. In its present state the book can rightfully be called the standard American work on tunneling.

In this new edition greater attention has been paid to the American method of excavating tunnels through rock and loose soil. Under this heading the crown-bar, heading and bench, and drift methods of driving tunnels, are given extensive treatment. Considerable space has also been devoted to descriptions of large and important tunnels recently built in order to illustrate and emphasize the characteristics of the various methods discussed in the text.

The introduction is an interesting exposition of the historical development of tunnel building. The first chapters treat of preliminary considerations, methods of surveying, excavating machines and rock drills. Chapter 4 is on the general methods of excavation, shafts and classification of tunnels. This is followed by treatments of the methods of timbering tunnels; hauling in tunnels; types of centers and molds; and methods of lining tunnels. Tunnels through hard rock are very completely treated in three chapters with descriptive illustrations of methods used in many important tunnels. Five chapters are devoted to tunnels through soft ground and open-cut tunneling. The chapters on submarine tunneling which follow are invaluable on account of the number of interesting descriptive illustrations of such work. A chapter on accidents and repairs in tunnels during and after construction contains many valuable suggestions and the actual solutions for many problems due to accidents. The subjects of relining timber-lined tunnels with masonry and ventilation and lighting during construction are treated in a concise manner. The final chapter on cost of tunnel excavation and time required for the work contains facts and figures regarding tunnel work in general.

The typography and illustrations, the general method of presentation of the subject and the arrangement of subject matter are to be commended. As a text and reference work this book can only be recommended most highly.

GENERAL SPECIFICATIONS FOR CONCRETE BRIDGES. By Wilbur J. Watson, Cleveland, Ohio. Paper; 11 x 8¼ inches; 66 pages; illustrated. Price, $1.00.

The 1913 reprint of the second edition of these well known specifications contains an addenda and errata sheet which makes the book more complete and up-to-date. As a general working basis for concrete bridge design and construction these specifications are to be commended. They are a long step toward the standardization of specifications for concrete bridge design, similar to what we now have for steel bridge design. Every bridge engineer should possess a copy of this book.

THE THEORY AND PRACTICE OF MECHANICS. By S. E. Slocum. Cloth; 6 x 9½ inches; 442 pages, with numerous text figures. Published by Henry Holt & Co., New York. Price, $3.00.

The aim of this text, as stated in the preface, is to present the fundamental principles of mechanics in such a way as to emphasize their actual significance and relationship and at the same time make them matters of intelligent interest to the average student. There can be no doubt that by properly combining theory and practice in the study of mechanics the student's interest is held at all times since he can readily see wherein the theory will find application in actual practice, and the efficiency of instruction is thereby greatly increased.

The first few pages are taken up by mathematical and physical constants, followed by chapters on kinematics, fundamental dynamical principles, statics, friction and lubrication, kinetics of particles, kinetics of rigid bodies and dynamics of rotation.

In each chapter the theory is amplified by direct application to practical problems and examples. Some material has been included which should not be taken up in an elementary course but is included to make the book more complete and valuable as a reference book, which such a work should be made after graduation, chiefly on account of greater confidence one has in a book with which he has become familiar during his undergraduate work.

The make-up, typography and general arrangement of the book are excellent and it should prove valuable as both a text and reference work.

PLANS OF GRAIN ELEVATORS. Third edition. Edited by C. S. Clark. Cloth; 9 x 12 inches; 378 pages; profusely illustrated. Published by the Grain Dealers' Journal, Chicago. Price, $5.00.

This volume contains plans of grain elevators and storehouses, together with descriptive articles taken from the files of the Grain Dealers' Journal, designed to assist grain dealers who contemplate building, in forming definite ideas as to what type of construction will be most suitable. The idea is not to furnish plans which can be used without alteration, but rather to impress the importance of obtaining the services of an experienced builder to carry out the construction. Special attention is called to mistakes and expensive experiments of those who believed that money could be saved by being their own architect and builder.

The book is divided into three general divisions, viz.: terminal elevators; transfer and cleaning elevators; and country elevators. That concrete is becoming the standard material for such construction is shown by the subject matter. Every grain elevator engineer, constructor and grain dealer should have a copy of this book.

The Maintenance of Way Department

Open Correspondence Column.

ON another page of this issue we print a letter in which the writer suggests that a "Correspondence" column be made a regular feature of the "Maintenance of Way" section.

We have been printing letters from time to time in which our subscribers comment on different subjects under discussion in this section. The letter mentioned, however, suggests that the idea be carried still further, and a column opened up in which subscribers may ask for suggestions on any question in which they are particularly interested, these questions to be answered by other subscribers.

The Editor takes pleasure in adopting, or rather extending the correspondence feature, and invites communications on any subject whatever, of interest to track men. Questions, answers, new methods, short cuts, etc., will not only be accepted, but will be welcomed.

The letter on page 589 gives so many suggestions that it is hardly necessary to enlarge upon them.

Although the enumeration of those who would be specially interested in these features, in the letter mentioned, includes only foremen and men lower down on the scale, it is certain that many ideas can be brought out in this way which will greatly interest the Roadmaster and Supervisor. At any rate it is probable that much of the material will be valuable for the Roadmaster or Supervisor to hand down to his foremen.

The "Open Correspondence Column" can be made a great success provided every foreman or track man lends his coöperation. Any reader is invited to send in contributions, no matter how unused to writing or how poor a penman he may be. Ideas with regard to track work are what is wanted. Writing and spelling can easily be corrected. It lies with the track men, who will be most benefited, to make the Correspondence Column a success, and thereby assure its continuance.

Reminiscenses

ON another page we publish an article entitled "Reminiscences of a Track Supervisor," in which the author recalls a time when it was necessary for him to flag the track in both directions, in order to make necessary repairs. This, he narrates, was a difficult matter with a gang of only two men.

Reading about this event will undoubtedly recall to the minds of our readers many interesting incidents of a similar nature, when track construction and maintenance were not on their present modern plane. A narration of such incidents not only interests track men, but tends to decrease the dissatisfaction with present day conditions, which it is conceded, are far from ideal.

On the other hand, a statement of the amount of work accomplished by the old time laborer or track gang will show a valuable, but not such a favorable, comparison with present day results. A contrast favorable to present day methods can be shown by comparing the work now done by power, with the same work as formerly done by hand.

Railway Engineering will be glad to publish a description of such incidents, and track men are invited to submit descriptions of conditions extraordinary at the time of occurrence, or in comparison with present practice.

BUYING QUALITY LABOR*

Ever since modern industrial development got under way, cheap labor has been an illusion and a scarecrow. Nations have shuddered at the possibility of breaking down barriers between themselves and other nations where wages are lower.

America has been afraid of Europe. Europe has been divided against itself, with John Bull worrying about the pauper labor of the Continent. And advanced industrial countries like France and Germany have been apprehensive about the peasant labor of Russia, Austria, and so on. The whole Occident has been terrified again and again by thoughts of the coolie labor of the Orient, put in terms of some vague peril.

This cheap-labor scarecrow has been useful to the politician in every land—particularly the politician out of office. All countries compete openly in the world's markets, holding trade on the products in which they excel through national genius, regardless of wages. The politician seeking to get back into power, however, or holding power against an enlightened opposition, has repeatedly played upon the fears of people by elaborating the cheap-labor scarecrow. Probably this fear, more than any other factor, is responsible for the vast military waste of nations, which increases the burden of living in an age when production might be unlimited, and which has finally put the whole world in a bad way for ready money with which to carry on its work.

As manufacturing establishments are improved and humanized, however, it is becoming clearer and clearer that in buying labor quality counts first, just as it does in materials, and that price is really secondary. As a general proposition, the thing has been proved over and over. For example, though our Southern states had slave labor under absolute control—an ideal situation in the eyes of the man who thinks of labor only in connection with its price by the day—every effort was made to attract high-grade workmen from the North. The South lost the Civil War largely through inability to manufacture weapons, tools, clothing, and other industrial products when the blockade cut off its supplies from Europe.

High Wages and Low Costs

If day-wages were the main issue, India ought to be a great industrial country, for it has unlimited cheap labor; but her few factory industries represent the survivals from a long list of failures. A Hindu coolie can be hired to tend a cotton loom for fifteen or twenty cents a day; but his value as a workman is hardly one-fifth that of an English operative. He takes frequent holidays, with or without notifying the boss.

Every summer from one to three months will be spent in his native village helping his family with the crops; and efforts to train or advance him are nullified, because hiring is in the hands of a muccadam, or labor contractor, who buys labor strictly by the lowest price, levies a tax on each coolie, and thus has a money interest in frequent changes.

Despite the abundance of cheap human muscle and time in the Orient, it has been found that success in building up an industrial plant there depends on installing as much labor-saving, foolproof machinery as would be needed in a land of well-paid labor—it is even more necessary, to avoid the uncertainties, delays, and losses due to cheap manual workers. Even when carrying is done on men's shoulders and women's heads, instead of by crane or light railway, the money saving through coolies at eight or ten cents a day is nothing at all.

*By James H. Collins in *The Saturday Evening Post*. Reprinted by permission of the Curtis Publishing Co.

The cheap-labor illusion is being exploded nowadays in everyday business. While governments collect statistics showing wages paid in different countries, and that the cheapest production is usually found where the most skillful employees earn the highest wages, the American manufacturer is arriving at the same truth through his own experience in the management of works and through his export connections.

A certain American factory making agricultural machinery pays its employees an average of more than fourteen dollars a week. As this includes all employees, the average is high. The superintendent of that plant has lately had considerable business with a concern in England making the same class of machinery and with about the same quantity of output, as nearly as comparisons can be made. Wages in the British plant average less than five dollars a week.

On the surface this American concern would seem to have every reason for fearing the cheap product of the English company. Yet they both meet as competitors in the Canadian Northwest; and, in spite of a preference in the Canadian tariff whereby British machinery comes in at a lower rate, the sales of the American concern in Canada are larger than those of all British manufacturers put together.

The reason for this is plain enough when the number of men on the payroll is known as well as the wages; for the English factory has two thousand employees, with a payroll of ten thousand dollars weekly, while the American factory turns out as much machinery with six hundred employees, with a payroll of eighty-five hundred dollars weekly.

A direct illustration came to the attention of an American manufacturer of lawn mowers. An English manufacturer visited his plant and wanted to know how many machines were produced daily.

"Somewhere round five hundred," replied the American. "The output varies, of course."

"Oh, but I say," protested the Englishman, skeptically, "how many do you really make?"

"Suppose you go through the plant yourself," suggested the American, "and see how many we are turning out. Go anywhere you please and ask all the questions you want."

That night the visitor returned to the office in astonishment at finding that the day's output had been about seven hundred and fifty finished machines. He confessed that sixty or seventy was a big day's output for him.

The American took him home to dinner and they compared plants and methods. This American factory has been going about seventy years and specializes strictly in lawn machinery. Only once did it venture into another line, and then at a heavy loss. Its employees are highly paid men, and it has every labor-saving device in the way of special jigs, milling machinery, and so on.

Production has been brought to such a fine point that a lawn mower can be made to retail at two dollars. The English factory makes almost any kind of small machinery for which it can get an order, and to get labor at the lowest price it employs many girls.

"Tell you what I'll do," said the American, after they had discussed costs; "I'll make you a better lawn mower than you now turn out, with grass catcher and extra knives, and I'll lay it down at your factory door in England, freight paid, for ten per cent less than your own costs."

The visitor said he dared not accept the offer, because it would put his factory out of business.

The same principle has lately worked out in our export trade in electrical machinery. Five years ago, before its political troubles, Mexico was in the market for electrical plant, with hot competition between American and German manufacturers. The Germans secured a good many of the earlier contracts on low prices, and it seemed for a time as though low wages might really have some advantage over high wages; but German electrical plant is said to be peculiar.

International Comparisons

At home, in the Fatherland, technical-school graduates are so plentiful that college men can be hired to operate electrical machinery for moderate salaries; and consequently switchboards and plant in general, built to conform to low bids, are not so sturdy and foolproof as the American plant, which is made to be operated by mechanics without technical education.

When the average Mexican workman got his hands on that German plant it did not stand up; and so American foolproof machinery steadily gained in favor in Mexico.

These international comparisons are coming up in all our industries to-day, and merely prove to the American employer on a large scale at a distance what he has been finding out on a small scale at home—namely, that the price paid a day for an employee's time may be the least important factor in buying labor. Purchase of labor is following that of materials. Quality counts; and the man who can earn most money in a day may be the cheapest when final results are figured out on the cost sheets.

Yesterday an immigrant was hired to do pick-and-shovel work. With an Irish foreman to push fifty of him along, and only a couple of dollars a man tied up in tools, it was natural to try to get as strong a man as one could for the minimum price a day.

To-day, however, it is the capital invested in costly equipment that counts first of all. This item is steadily rising. A man must be able to get a profit out of a steam shovel, and perhaps he will also have opportunities to prevent losses from other equipment or from other employees.

A big quarry was equipped with every modern device for getting out stone economically—first-rate drills and air plant, steam shovels, derricks, light railway, and so on. All this equipment was in charge of well-paid mechanics. Yet there was loss from idle time. One day the mechanical plant would be so crowded with work that overtime was necessary, and the next day shovel and derrick men would be waiting for stone.

An air-drill engineer and a powder salesman looked into this difficulty, because it reflected directly on their kind of equipment; and they found that the trouble lay wholly in buying one kind of labor at the lowest price instead of by quality.

Drilling and blasting in that quarry were regarded as rough work, calling for little skill or intelligence; and the crew that did it was made up of cheap laborers under a cheap foreman. When this crew was strengthened with picked quarry men, put under the best foreman to be found in that section, and its payroll about doubled, everything ran smoothly. Holes were properly spaced and loaded, the day's work laid out according to the character of the material, and the stone broken out on a regular schedule that kept costly mechanical equipment working at a profit.

Again, there was a bitter complaint from the public about an Eastern trolley company. Charges of poor service, antiquated equipment, and domineering employees finally led the public-service commission of that state to investigate.

It was found that upkeep of equipment had been neglected so that the company could pay dividends; track was in bad shape; poles and wires needed overhauling; a leaking current was damaging other people's property by electrolysis; but the chief shortcoming was due to cheap labor. Wages paid motormen and conductors by that company were nearly the lowest in the state. Yet its costs a car mile for those employees were by far the largest in the state, and its power costs were also very heavy.

Good trolley managers have found it to be a truth in the business that a careless motorman, backed by a careless man on the rear platform, can just about double power consumption and eat up dividends in labor expense. On this road, cheap motormen and conductors were giving a practical demonstration of that truth.

Two railroads lately compared their expenses in upkeep of locomotives. To maintain engines in good order, one road laid

out a dollar, while the other's upkeep ran to two dollars and sixty cents. The road that did the work for a dollar was spending eighty cents for labor and only twenty cents for materials. It had high-grade mechanics, who watched equipment closely, made few adjustments and repairs, and promptly reported serious defects.

The other road was paying its upkeep men only thirty-five cents in wages as against sixty-five cents for materials. These men let the little adjustments go from day to day, did not detect serious shortcomings, and repairs might not be made until there was a breakdown.

The superintendent of the first road, with the lowest upkeep expense, had often been chaffed about the fancy looks of his locomotives, in the belief that he spent too much money for cleaning, polishing, and tinkering—and that a dirty, battered engine ran just as well. But his cost sheets straight down the line proved that by investing in the best labor he could buy he was really getting his upkeep at bargain-counter prices.

In the average American factory the employer has about twenty-eight hundred dollars invested for each wage-earner regularly on the payroll—that represents machinery equipment, fixtures, buildings, real estate, and so on. For each person on the payroll the boss provides nearly three mechanical horsepower. For each dollar paid in wages he buys four dollars' worth of raw materials, and also spends nearly thirty cents for office expenses. Percentage of increase in items like capital, raw materials, power, and supervision is greater than the rate of increase in wages.

That is the broad average for the whole census. In many factories the investment in machinery is far greater; so there will be a tremendous difference in ratio between the value and overhead expense of a big machine and the day wages of the man who operates it.

Therefore costs are being figured less and less in terms of wages, and more and more machine production. The vital point about an employee is, not how much he gets a day or how many hours he works, but how much he can do with a given machine.

If he can increase the output but a trifle, labor costs are reduced; and each additional increase in production cuts costs in a steadily progressing ratio by trimming down the overhead expenses.

Each improvement in the quality of output cuts labor costs, and so does each reduction in defective work—often a very heavy item.

The actual money saving on the cost sheets is only part of the benefit; for a high-grade workman in a high-grade job facilitates deliveries, helps sales, and forwards the whole organization. A few dollars additional in his pay envelope may count so little that it would be worth the money to be certain he will turn up beside his machine every morning when the whistle blows.

Thousands on thousands of employers are still blind to this quality view of the payroll. They anxiously watch the gross amount handed out by the pay clerk on Saturday, thinking that is the vital element in labor costs. A level cut in wages is their only understanding of a reduction in those costs. If they hear that a competitor at home is working longer hours or paying two dollars a week less for shop hands, it keeps them awake nights; and when Congress takes up its perpetual inquiry into tariff reduction, they send an attorney to Washington with some pitiful wage tables.

The employer who has learned to buy and utilize quality in his employees worries very little about such side issues, because he has developed broader views and greater resources.

He understands that good supervision and organization must be behind the workmen and the plant in cutting down labor costs. Instead of putting all the blame on the pay roll, therefore, he does his share at the thinking and planning end. He realizes that quality in workpeople is rather a spirit based on personal self-respect and higher aims in life than any special ability of individuals.

Correspondence.

Editor, Railway Engineering:

Since May, 1911, when *Railway Engineering and Maintenance of Way* absorbed "Roadmaster and Foreman," the opportunity for an exchange of views has very nearly been done away with, for the so-called "small fellows"—the laborer, the trackman, the section foreman, the extra gang foreman, and the division track laying foreman.

I have before me an old copy of Roadmaster and Foreman and it has a prize contest on the subject, "What Is the Best Manner or Method of Renewing Ties." Tom, Dick and Harry have written their method of renewing ties, and, for the "small fellow" it is very valuable. He reads of other men's methods, he has a chance to compare them with his own, or, if he reads of a method that he thinks is better than his own, he tries it out after mastering it by study.

The Foreman thereby improves, and learning more about his work, becomes a more valuable man to his roadmaster. The roadmaster sorely needs the section foreman who does not require a great deal of supervision, for it allows him more time to be at places where his presence is greatly needed.

On the title page of your journal under the heading "A Monthly Railway Journal," is the statement, "Communications on any topic suitable to our columns are solicited."

Any magazine which has an inclination to instruct the "small fellows" in the topics it discusses should have an "Open Correspondence Column."

I think an open correspondence column helps to build up any magazine which maintains one, because no man knows it all. A man may have a job a couple of months ahead of him, and give the details in this column, naming the conditions under which job must be done and ask for opinions on the best way to be handled. Or, after having done a certain job in a certain manner, he could write a statement on method of procedure.

There may be many men who will belittle the proposition simply because they may know how to do many different classes and kinds of work and think it is beneath them to participate. Then again, others may be too modest to write, because they may show that they have not acquired education in spelling, etc., but that can be gotten over very easily by a frank statement from the editor that what he wants is the news and he will personally see that all misspelled words will be corrected confidentially, thereby causing no embarrassment to the sender and encouraging the modest to write their opinions.

A correspondence column for Maintenance of Way could include: (1) renewing ties, (2) ballasting, (3) reballasting, (4) resurfacing, (5) methods of ditching, (6) handling work in tunnels, (7) in snow sheds, (8) on long single or double track bridges, (9) relaying steel, (10) new track, (11) laying switches, (12) crossovers, (13) crossings, (14) sidings, (15) all kinds of crossings and how to make measurements on them, (16) double slip switches, (17) handling snow, (18) methods of handling work-train gangs and (19) how to build road crossings.

Encourage and demand that the small details be included in the writings; not "I took 14 men and put in a railroad crossing" or something to that effect, but explain how measurements were made and how men were disposed or placed at the time of breaking the track, how long the track was actually open, how the ties were put in, the correct manner of cutting rails, the objections to the present methods of cutting rails, how to bend rails for different radii, and how much should a rail be bent over the needed measurement to be sure that the spring in the rail will not take it back over the ordinate needed, also how to best line track, how to surface tangents, curves, etc.

(Signed) L. Howard Smith.

The Norfolk Southern, it is said, will build a depot at Charlotte, N. C.

REMINISCENCES OF A TRACK SUPERVISOR.

J. W. Powers, Supervisor.

When we stop to compare the material used in constructing and repairing the railroad of today, we are astounded at the marvelous change which has taken place during the past quarter of a century.

Many of the American railroads twenty-five years ago were using the old iron rail, with fish plates to support the joints, and even this style of rail and joint were considered a vast improvement over the old chair iron and wood block joint which had been discarded upon the adoption of the fish plate rail. Owing to the light engines and small cars in general use at that time, these rails and fastenings gave satisfactory results for a few years. But after a short time these rails had outlived their usefulness by becoming battered in different places, especially at the joints. It was sometimes necessary to change as many as ten rails per day on a section six or seven miles in length. This occurred usually during the severe winter months, which required extra precaution to keep the track in safe condition with the material furnished by the majority of railroads of that day.

I can recollect, after twenty-five years, my last experience where these rails were used. At that time we had no emergency rail rests as we have at the present time. It was immaterial whether rests were furnished or not as we had no whole lengths of rail to use, but had a quantity of battered rails which had been removed out of track. When it became necessary to get whole rails to change out the defective ones, we placed several of these pieces on the ends of the ties parallel to the rails of the track, drilled and bolted enough of them together to take out several good rails and the latter were used to replace defective ones at points where there was only one battered one to remove.

The old cast and yoke frog and stub switch were boon companions of the old iron rail. To say that they were a common source of annoyance and an element of danger would be expressing it mildly. The rails in stub switches were either pulling apart in the winter or running together in the summer, especially where the switch was located on a grade, so that on a summer day it was sometimes next to impossible to throw the switch, while in the winter they pulled so far apart at the head block that the rails and chairs were often broken.

I have a pleasant recollection of an experience with one of these stub switches. Returning from work with my section force which consisted of two men, one January evening while the thermometer was hovering around the 25° below zero mark, I discovered four broken rails in a three throw stub switch. Flag protection from both directions was required in order to make necessary repairs. The switch was located a short distance from a country station and after consulting the station agent as to the advisability of his protecting us in one direction, in which the case was argued pro and con, he finally acceded to my point of view. After sending one-half of my force to protect in the opposite direction and being convinced that my force was properly distributed, I, with the remaining half proceeded to make the necessary repairs. Seriously, many radical changes have taken place since that time.

During the above mentioned period, which was just prior to the New York Central & Hudson River R. R. leasing the road on which I was employed, it was next to impossible to secure material in sufficient quantities to make the necessary repairs. In order to secure our shimmed track it became necessary to pull spikes out of our sidings. A pretence was made of furnishing frost spike, for shimming, which consisted of bolts sharpened on one end with the head battered on the other. Even these were furnished in insufficient numbers to meet the required demands. The amount of shimwood furnished was also insufficient for the demand and so it became necessary for the foreman to exchange old ties with the farmers along the right of way, for wood which could be utilized for shims. But what a contrast between the shimwood then and that of the present time. It is now furnished in the size required, sawed and bored and of sufficient quantity to meet the demand.

The adoption of heavier power and increased speed necessitated an increase in the weight of rail which has been gradually increasing until at the present time a rail as high as 140 pounds per yards has been used. The old yoke frog has been replaced by modern spring and manganese frogs while a new reinforced steel switch point has transplanted the old stub switch.

The latest improved clamps and braces are provided to hold our guard rails in place, as are also tie plates of sufficient quantity and quality to hold our track in gauge and to protect our spike from the shearing action of the rail. Ties have been treated with the view of increasing, if not doubling their life. Stone and gravel ballast is used extensively on all first-class roads. Old stone box and wooden culverts have been replaced by concrete and cast iron pipe. The wooden bent and pile trestles have sunk into oblivion and have been supplanted by concrete or steel bridges.

The railroad of today comprises these and other improvements too numerous to mention, that have been contributed to the safety and comfort of what appears to be an unappreciative public which does not seem to realize what an enormous expenditure these entail, but is ever ready, upon the slightest provocation, to severely criticize the corporations which have made possible such marvelous progress.

GANGS AND THEIR RELATION TO TRACK MAINTENANCE.

By C. Clay.

There has been a growing tendency, during the past three or four years, toward the revision of track work with reference to the gangs employed. Several elements have entered into this, such as economy, labor conditions, etc., differing with the locality. In some cases it has been found impossible to maintain an extra gang and the section forces have been increased to handle work formerly handled by extra gangs. Naturally the question has arisen as to whether it would not be more economical to handle the work with section forces instead of extra gangs. Necessity having forced the issue, it has been placed beyond the theoretical stage and the fact exists that work has been done which would tend to show that increased section forces are capable of handling all maintenance and renewal work. There is one exception to this, and that where reballasting is being executed, extra gangs are the cheaper if the raise is more than a very light one. Another thing that would enter into consideration would be the capability of the section foremen. It is not every foreman that can handle men to advantage, and in some cases to increase a section gang above the usual limit will mean that the foreman, being unable to line them up, will have men looking at him half the time. As there are a number of matters to enter into consideration while mapping out track work, possibly it would be better to handle the matter under different items.

In ordinary maintenance work it is preferable that gangs be maintained at a proper size to take care of each and every section. In this, mileage and other matters on each and every section must enter into consideration. Some roads adopt a stipulated allowance for regular work, which is a standard for the year round, others an allowance differing with the months and conditions. Certainly it would seem preferable from a labor standpoint that a regular basis be adopted. While in some localities conditions are so severe that but little work can be done in the winter, there are others where conditions are equal the year round. This could be handled on a regular basis by having a summer and winter schedule as to the number of men that shall be employed. If possible to handle this financially, it would mean a great saving in track work. The railroads have a sufficient number of years behind them so that it

would appear an easy matter to judge what amount should be spent regularly on maintenance. The saving would be effected by reason of there always being a certain number of men on each section who were familiar with the work. Where the allowance is subject to fluctuations governed by financial matters, there is a difficulty in obtaining the men required at the time that the money is on hand to employ them with. If your sections sometimes have three men and sometimes six men, varying from month to month, of necessity there are only three men on each section who are fully versed in the conditions of each section and the work. While the other three, at the time that six can be used, may be experienced men, it is rarely so, because there is no incentive in the way of regular work. They realize that they may only work for a month or two, and take no interest in it. If the foreman attempts to get an average day's work out of them, he is confronted with the problem of getting another to take their place, and the others are probably equally as bad. This consideration would not interfere with the increasing of section forces to do extra gang work, as they would then be under the same conditions as extra gangs. Section forces should be apportioned with reference to the amount of work on each section, and the financial condition of the road. This should be adjudged an ordinary expense and gangs maintained on that basis. All other expenses should be considered as extraordinary and the gangs increased or extra gangs placed on to take care of such contingencies as might arise under this head. All too frequently section gangs are called on for assistance in station work; while the necessity for this at times exists, there are frequently cases where the agent could hire men who would do the work more economically when their cost in relation to the holding of track gangs from track work is considered. Where there is a standard maintained for the size of track gangs, such expense is more easily taken care of in hiring extra men to take up time spent in station work.

As the position of extra gang foreman is considered a promotion from that of section foreman, and only a few foremen make extra gang foremen, the doubt as to the economical size of a section force would rest with the capability of the section foremen. If the foreman is capable of handling a sufficient number of men for the purpose and the men can be obtained and reside at his headquarters, there is no doubt that the increased force is more economical. Some foremen object to having other foremen on their sections; when such is the case it can be relied upon that they take an interest in their sections and will take more interest in the work on their particular section than an extra gang foreman would. But even then there is a danger of raising the number of men on a section to a number too large to be efficient.

Where a large amount of rail is to be relaid, an extra gang should be used. Still fewer foremen are capable of relaying the rail over their section in a continuous stretch than are capable of other extra work. In addition to this, it is generally conceded that the most economical gang for relaying rail is between fifty and sixty men. While such a gang might be raised at each section headquarters in the East, there are a great majority of places where this could not be done. True it is that the men might be raised as a gang, and residing in cars, they with the necessary tools might be sent from one section to the next. But while the first foreman might be capable of relaying the rail on his section, the next one might not. Therefore it would appear preferable that an extra gang with foreman be used to relay rail in extensive renewals.

The surfacing of the rail is a different matter and it would seem more economical that the section gang be increased to between fifteen and twenty men, taking single track as a basis, each section foreman tieing and surfacing his own section. Such a gang would not be too large to handle and the foreman being better acquainted with his track could do the work to better advantage. As the steel gang reached each section, the section forces would be augmented and the gang get in behind the steel gang and surface. In such handling, the taking out of ties that were fit for further service would be eliminated and this is sometimes a cause of complaint against extra gangs. In increasing the section forces for such work the cost of boarding and other cars connected with an outfit is done away with, in addition to the expense of an extra gang foreman and other minor ones. Also with the fifteen or twenty men the supposition is tenable and in some cases becomes a fact, that a greater amount of work is done in ratio with the number of men employed than with the larger extra gang.

Where a section has run down from causes beyond control (because if it were owing to the inability or inattention of the foreman or similar cause, such running down would be controlled), in some localities an extra gang is placed there to surface and tie such piece of track. In this there is the added expense of the foreman, cars for the outfit, etc., which an increased section force would obviate. Or two section gangs might be increased and work toward each other. For instance, if the sections are six miles in length and a stretch of eight miles was in need of surfacing, both of the sections on which this stretch of track was, can be given larger forces and then work toward each other. There is one consideration that would have to enter into anything of this nature, and that would be the time taken to and from work. If there is a side track convenient to the center of the piece of track which it is desired to surface, then it would be far cheaper to have a small extra gang spurred out there and let them work both ways and in this way eliminate the lost time in getting from section headquarters. Another consideration would be the maintenance of a gang at a size sufficiently large to be effective. Local matters must always govern questions of this nature, so that a hard and fast rule cannot be made. Where at some seasons an extra gang could be maintained at a proper size with ease, at other seasons it would be impossible to do so. In any case, extra gang laborers are of a migratory nature and one is never certain as to what size an extra gang will be reduced by the next day. So that it is ever preferable to increase section forces for such work where there is no increased outlay. In addition the foreman has his regular men who are accustomed to his manner of doing work, who act as leaders, and better work results from the whole gang. For heavy renewals which will only take three or four days at the most, the section forces need not be increased. In such cases the adjoining section forces can be sent there to assist. What extra time is spent on hand cars, providing the distance is not too far, is offset by the time it would take men unaccustomed to the foreman's manner of working to get strung out. Then every few days there would be the necessity of issuing discharge checks, which is generally frowned on by the Treasury Department. Also, where extra men are placed on for a few days only, one has to keep a large surplus of tools to take care of such contingencies.

In ballasting it would seem preferable to use extra gangs and re-ballasting with a heavy raise, extra gangs also; that is, where there is a heavy raise in long stretches. In re-ballasting for patch work, the section forces are usually capable of taking care of it, or if a light raise, then increased section forces would be more economical. After a heavy raise in ballast, there is always a certain amount of settling which develops rough places and low joints. Even putting in the ballast with increased section forces could not overcome this, though their work was better than that of extra gangs. Usually in ballasting or reballasting with a heavy raise, the ballast will come so fast from the crusher or pit that increased section forces would have to be very large for a section to take care of it, and a certain amount of confusion would arise in the distributing of the ballast and it is a profanation in the eyes of the contractor furnishing the ballast to have to choke down his output. In using extra gangs, they can follow right along and put up the ballast in a continuous stretch, whereas with increased section forces there would be a patch of ballast with other patches ahead of it going in, and an increased cost to the work train

in addition to the confusion that would result from such handling. In patch work where the various unloadings are of necessity some distance from one another or even close together, it is better to increase the section forces and let each foreman insert such ballast on his own section.

As the extra gang foremen are promoted from section foremen, it means the placing of a temporary man on the section while the regular foreman is on the extra gang. This is in itself one reason for sections getting rough because it is difficult to know what a man in such circumstances will do, and a man temporarily placed in charge of a section, knowing this in the majority of cases, does not do his best. Therefore it would seem better that where the work can be done by that method, it is preferable to employ increased section forces than to use extra gangs.

MAINTENANCE A QUESTION OF INSTRUCTION AND SUPERVISION.

C. E. Lindsay, Division Engineer.

In our territory gangs are large and traffic is dense and the foremen have all they can do to take care of their own sections, and it is disorganizing to take them away from their own sections to do extra gang work. The labor conditions in this country are such that, except for the nucleus or few old men who are retained on the sections during the winter, the same class of men is employed on sections that is employed in extra gangs, so that the question of any work done properly is one of instruction and supervision, and can be done as well by extra gangs as by the regular section gangs. The doing of heavy renewals by extra gangs permits the section foreman to devote his time systematically to the general maintenance and renewal of his tracks and to give more attention to the fine details.

Extra gang foremen are promoted from section foremen. Some of the older and more experienced section foremen are capable of handling larger gangs in reballasting and relaying; that is a question of the man, his age, education and experience.

EXPERIENCE WITH HIGH WATER ON TRACK.

O. A. McCombs, Roadmaster.

There are almost as many different methods of repairing washouts as there are washouts. Sometimes a small, insignificant stream, with plenty of openings through the track, will get up on a rampage and cut out a piece of embankment where least expected. I saw one washout on a small dry branch where there was no water ever running except a short time after a rain. This stream bed just touched the right of way on the upstream side, then turned away from track, and, coming back to track again, went through an ample opening about two hundred feet farther downstream. One morning a heavy local rain on this stream put the water up in it, and the water cut out thirty feet of embankment where it touched the embankment on the upstream side of the bridge, and left the track swinging. Before the track walker reached this place a passenger train found it, with disastrous results.

This embankment had been about four or five feet high and was cut out to the bottom. Two or three cars of good rip-rap stone properly placed at this point would have prevented this washout. We cribbed up with ties and old bridge timbers, in order to get trains by promptly; then we filled it with earth, taking out all the ties and timbers we could conveniently. We then rip-rapped it on the upstream side with one man stone, and there was no more trouble.

At another washout we had a trestle carried away. This was a frame bent trestle on pile foundations, the west approach to a span over the main stream. It contained sixty-two bents twenty-eight feet high. When this trestle gave way, it broke first near the embankment, farthest from the span, and the deck of the bridge, consisting of the rails, ties, stringers and guard rails, swung around downstream and was held by the pier at the end of span. Every bent in this trestle went out except the four first bents next to the span. These four first bents had settled on the upstream end at some time previously, and we had driven an extra pile on the upstream side of each to prevent further settling. The deck was pulled off of the four bents by the stream, but the pier held it. The piers were originally steel piers on rock foundation, but they had been enveloped in concrete, making a concrete pier reinforced with steel. The span was held in place by heavily loaded cars, and did not go out. This trestle could have been saved by the addition of one pile to each bent on the upstream side, as was demonstrated by the four bents holding, even standing the extra strain of having the deck pulled off of them by the other part of the trestle giving way. The approaches did not give way. The east one had a concrete abutment, the west one earth embankment well rip-rapped with rock.

As soon as the water subsided a few feet, we commenced to rebuild this trestle, working four crews, two day and two night shifts. With a pile driver at each end, working day and night, we drove three piles to the bent until we got trains to running. Then we put two more piles to the bent and finished the trestle. The first three piles driven were the two outside batter piles and the center pile. We had the trestle rebuilt and trains running before the water had subsided from the lowlands into the channel of the stream.

After the water subsided, we brought the rails and the deck back to the new trestle on push-cars and it was loaded from the ground onto cars with a timber hoist. The water had left

Fig. 1. Lower Side of Embankment Rip Rapped.

the deck in such shape that it was possible to use a push-car on it, and by tearing it apart one rail at a time, track material was moved near enough to the trestle to reach it with the hoist.

At another washout the water carried away four or five hundred feet of embankment about ten feet high and left the track in the borrow pit on the downstream side. The embankment was cut down six to eight feet below the grade line of track. We graded this by cutting down the high places and filling the low places, and then graded an incline down at each end into the depression made by the washout. We took the track apart, and rebuilt it on the new grade line through the depression, and operated trains through there until we could raise it. To fill this washout and to raise the track to grade we loaded material with steam shovel and unloaded with a Lidgerwood unloader.

At one time I had charge of a piece of track through a low piece of swamp, that was subject to overflow during the heavy spring rains. The current was not very swift, but the water would get up over the track eight or ten inches and stay that way for several days. The current would cut out the ballast here and there from under the downstream end of the ties, and cut out the dump in little holes up to and under the ends of the ties on the downstream side, just enough to put the track out of commission. This track was rock-ballasted and filled to top of ties on about a three feet dump. After one of these freshets had subsided, we decided to rip-rap the downstream side of the embankment. We rip-rapped from the bottom of the embankment to about the top of the rail. The top of the rip-rap was about six feet from the top of the rail on the downstream side, and had about a two-to-one slope. (See Fig. 1.) The next rise did not injure the track and we had no further washouts at this place. We operated trains over this piece of track several days at a time with the water above the rail. We ran a hand-car ahead of each train and inspected track

carefully to see that no part of the roadbed was washed out. Later this condition was remedied permanently by raising the track and making larger openings for the water to pass through.

We had another piece of track where the high water frequently washed the track off of the embankment into the borrow, but did not cut the embankment to any great extent. This was about an eight-foot embankment and track on rock ballast.

As a preventive in this case, we drove a pile about two feet out from the end of ties on the upstream side of track at every joint and center of rail. (See Fig. 2.) These piles had an average penetration of about eight feet and the top of pile was about flush with the top of rail. We anchored the track to these piles with good, heavy wire. The next freshet that came was of greater violence than any that had preceded it since the embankment had been built, and it washed part of the track away, and some of the piles in one place, and cut quite a hole in the embankment; but the most of the piles held and track was left in better shape than it had been in previous washouts. This defect was remedied permanently by raising the track higher and making the openings larger and rip-rapping the embankment at the ends of bridges.

At another place, where the river ran parallel to the track on the upstream side, during one of its high-water stages the river began to scour out the embankment. The water was up to within about a foot of the botttom of ties and had cut the

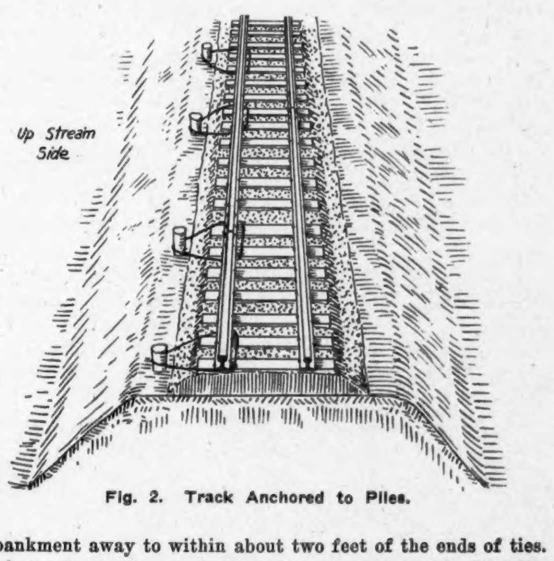


Fig. 2. Track Anchored to Piles.

embankment away to within about two feet of the ends of ties. We had a large force and a lot of empty sacks. We filled the sacks with earth and sand and dropped them into this wash until we filled it and thus saved a break in the track there. Afterwards the wash was filled with earth and rip-rapped and caused no further trouble.

In one place I am familiar with, and I suppose there are a number of other places where the conditions are the same, a city is built on the east bank of a river, on high ground, and the river was never known to overflow. Just across the river from the city is a bottom or lowland that sometimes overflowed. As the land in the city gets more valuable, the people that own the low land are filling up lots, building houses and fences, etc. There are several railway embankments and trestles through the lowlands, and spans across the channel. There is an embankment for a highway road, and a government lock and dam on the river below the city, and several bridges for vehicles. Property owners with riparian rights fill these lands out and encroach on the river. The city had a garbage dump in the bottom; there are also some private dumping grounds. All these things filled up the bottoms and decreased the river channel. Then a big rise came, overflowed the highway and the railway embankments, cutting them out and destroying them in several places, cut off the water supply, and overflowed the electric light and power plant, putting the city in darkness and street cars out of commission. In the bottoms across the river everything that would float was swept away. I think in a situation like this, a sufficient opening should be left along the river for the passage of water; and people should not be allowed to fill up the lowlands within a certain zone near the river.

We cannot expect to keep a stream of water within a proscribed area, unless the area is large enough to accommodate the water.

PERMANENT EXTRA GANGS.

E. K. Coggins.

Section gangs should be large enough to handle the general repair work; under ordinary conditions, a foreman and six men can take care of six miles of main track, and do all the work necessary to keep it in good repair, and will only require extra help in relaying rail, heavy ballasting, etc. In all cases, that work should be handled by extra gangs rather than by combining the adjoining section crews.

The salaries of the several foremen cause section labor to average in cost more when they are doubled, or bunched, than an extra gang of the same number of men; besides, a great deal of time is lost from the work in getting the men to and from their headquarters on lever cars. The lack of organization is another loss to be reckoned with, for when two or more forces are combined, there is always more or less confusion and dispute among the men with reference to the best methods of doing the work, ownership of tools, etc. The greatest loss, however, is the time spent by each section crew away from its own regular repair work; for it requires constant care and steady work to maintain track in a good and safe condition, and when a day is lost it is hard to regain.

Work that is done by extra gangs, as a rule, is not quite as good, or is not finished in as workmanlike style as that done by regular section men. On acount of this feature, is is always a good idea when a section is being relayed, to work the section force close behind the gang, to look after the "odds and ends." Spikes that have not been driven properly should be redrawn, the holes plugged and the spikes redriven, and there are a thousand other little things that need to be given attention at that time, which mean serious damage to the rail or track if neglected, and would be left undone or escape the notice of a foreman with less interest than the one whose duty it will be to keep up the track after the extra gang has gone.

The above applies as well to the work of building new track, or ballasting, as to rail laying, for there is always plenty of work left for the section men that can best be done close behind the gang, with a small, well-organized force.

When there is no rail laying or ballasting to be done, an extra gang should be kept on at least every one hundred miles of each roadmaster's territory to handle and distribute crossties and other material. On that amount of track there is more or less heavy ditching, with long hauls of dirt that cannot be handled to very good advantage with the small section forces. There are wrecks to clear, new tracks to be built, and other heavy work coming up all the time that has to be handled by the section men, at a much greater cost unless extra gangs are kept for this purpose.

As a general proposition, it is easier to obtain extra gang labor, as the boarding cars offer an inducement that appeals to the fellow out of work, without a home or money to pay for his keep, and men can be obtained in this way to do the heavy track work that would do something easier were it not for this advantage. A good extra gang foreman is harder to get. He should be the best "all-round" man on the division, well experienced in all classes of maintenance work, capable of handling labor to good advantage under all conditions. Foremen who belong to that class are, as a rule, well located and satisfied with their work, and do not like the idea of being away from their families.

A great many section foremen can handle small forces to good advantage, and give satisfaction on general section work, such as putting in cross-ties, surfacing, lining, etc., who would not make good with a large gang relaying rail, putting in ballast, etc.

The scarcity of labor at many locations makes it impossible to perform all maintenance work without extra gangs, and it seems that the small section gang, aided occasionally by extra or movable forces, is the only solution of the problem.

EFFECT OF DRAINAGE ON SLIDES.

R. Roberts, Roadmaster.

Referring to slides, sink holes and track heaving or raising on account of invisible or under ground slides, will state that I have had a good deal of experience with all of the above conditions and it would be next to impossible to describe all of these places by sketch or photograph.

Many of these slides that I have in mind started at time of construction and some started several years after road had been in service. I have used a number of different methods to keep track in service. Where there is a slide of any size it is the best policy to build a temporary track around it where there is room enough to get around, putting in a switch at each end, a sufficient distance from each side of slide to have track enough to hold engine and three or four cars. This will enable you to work at each end of slide without interfering with traffic.

I have had experience with different kinds of limestone and soapstone, varying from two inches to nine inches in thickness; of these I think the soapstone the most treacherous; also have had some experience with clay or gumbo, which makes a very ugly slide to take care of.

We have used different remedies to check these slides; have built dry walls, drove piling, rip rapped with old ties, etc., but the best remedy is drainage, i. e., surface drainage.

Make a good deep surface ditch above the slide to keep all the water possible out of crevices, then put in a parallel ditch on top of the ground that is moving.

There are usually a lot of basins in these slides which should be well drained; if there are no secret springs this will remedy the trouble; if there are springs or under ground streams this will lessen the trouble.

THE EFFICIENT SECTION FOREMAN.

W. D. Carey, Extra Foreman.

The average section foreman has, in reality, many things to do and contend with, although to the uninitiated it would seem that his duties and responsibilities were rather insignificant.

In the making and maintaining of improvements the sectionmen have considerable to do, in persistent detail, and it will not be denied that if the foreman making these improvements conscientiously and with all possible interest in his work succeeds in pleasing both the management and himself, he has indeed accomplished much. But he cannot accomplish such results without the full and complete coöperation of his men.

It is not my intention in this article to go into detail regarding the actual work of the section crew, but I want to talk a little about the average foreman himself—his duties in the proper handling of his men, his personality, and so forth. And I intend it to apply most particularly to the foreman just advanced from the ranks.

The average railroader—the man who is properly interested in his work—is constantly working for promotion. It is a laudable ambition, and more often than otherwise the effort is fruitful. But promotions affect different individuals and dispositions in different ways. Some, after promotion, will proceed in the same general way, not being affected with over-importance of demeanor; others will be filled with anxiety and a feeling of hesitancy, not being so sure of their ability to deal with the new situation, and others assume such importance on account of the advancement that the real benefits which should accrue all around are handicapped.

It has been my privilege to be connected with railroad work of all kinds for a number of years. I have worked with all kinds of men and under all kinds of foremen. I have seen the results of promotion to foremen over different classes of work and to many differently dispositioned men.

From all my observations, I think I can say that the result of the promotion of a foreman from the ranks of the section crew is of great importance (to the man promoted), so much so that by far the majority of those so promoted assume an attitude which injuriously affects the results obtained from their men.

Although the new foreman knows just what he did know about every detail of the work when he was a hand, there are a few things that he has not previously had occasion to think about. But he will learn, it is to be hoped; and he must learn, sooner or later, that there is a right way and a wrong way to handle his men. And really this is his all-important job from the start. It is, therefore, very important that he start correctly. Many a good foreman can attest to this, and many an otherwise good future foreman has been a failure simply from making the wrong start.

It is a fact that in assuming this new role he should understand he is now in the position of a teacher as well as that of a supervisor. We all know that much of the section crew labor is unskilled; in fact, almost all of it. The average foreman has under his control men who never have known anything about the work, and many of these, even after some experience, do not see the wherefore of this or that and do not get the knack of the different tools with which they have to work.

Men as a rule do not stay long with the section. The new man is, therefore, almost constantly before the foreman in charge.

It is my contention that if the foreman would exercise properly the duties of a director and a teacher and become the possessor of an equable and generous disposition, he not only would do better work for his company but would the more greatly benefit in the matter of his standing with both his employers and his employes.

But there is not much hope for the man who starts out with a well grounded feeling of importance in the knowledge that from now on he is a "boss." With this disposition he develops into a driver of men, and, literally speaking, he keeps on "driving men off the job."—*Santa Fe Magazine.*

FOREMEN FOR EXTRA GANGS.

S. J. Evans.

Track surely should be wholly maintained by section gangs made large enough to handle all maintenance of track throughout the year, not increasing the gangs for special work, such as tie renewals, weed cutting, etc.; if the average number of laborers during the year is six, why not give six men steady employment the year around, thus hiring and retaining experienced laborers instead of inexperienced men who retard the work, and knowing that they are hired for a short time, will not take much interest in the work and naturally will become shiftless. Such men are a constant worry to the foreman.

Many ambitious foremen become discouraged by such labor and will either leave employ of railroads or will discharge the lax laborers. As these men are usually employed through agents of the same nationality, such a foreman will be reported as prejudiced against the race and will be short handed during the busy season. He is usually censured because he does not "get along" with his men.

By keeping steady gangs the year around this would not occur. The foremen would be able to select and retain good men. We know that men who have had one or two years'

experience will turn out from 25 per cent to 50 per cent more work than green hands who are hired for a short time only; therefore it is far more economical to keep an average gang throughout the year than to reduce at certain periods and increase at others. Foremen can then arrange their work so that they will be in a position to make repairs at the proper time. We all know there is a time in the year when certain portions of track work can be handled with much less expense than at any other time. For instance, in tie renewals, when the ground is moist ties can be renewed two or three cents per tie cheaper than one or two months later when the ground is dry and consequently hard.

If given the opportunity, a section foreman will be found taking time by the forelock, as the section foreman is a true economist and was the first "efficiency engineer."

The average section foreman of three to four years' experience is more capable of handling ballasting and rail renewing gangs than the average "floating" extra gang foreman.

The extra gang foreman who is hired from the outside is frequently incompetent, and he depends for his success on getting an experienced assistant or a man in the gang who is able to raise, surface and line.

Remember, I do not wish to give the impression that I am prejudiced against extra gang foremen, for I know some extra foremen who are experts in all branches of track work. But the average "floating" foreman works for salary alone, cares nothing for quality but considers only the quantity of work turned out, which oft'times is abnormally large, thereby giving the impression that a large amount of work is being done for a small expenditure. Foremen who are doing honest work are "called up on the carpet" to explain why they are falling far below the average per man of these hustling (?) foremen; when called to account for the poor quality of the work turned out the "floating" foreman will call for a clearance and drift off to some other road.

A great deal of the poor work turned out is caused by some official higher up requesting a stated amount of work per man, which is greatly in excess of what could be done honestly and thoroughly, therefore the quality must be sacrificed. I recall an instance of this kind which occurred a number of years ago: A bulletin was issued and a copy was sent each week to all extra gang foremen. It showed the number of feet per man turned out by each gang. This caused rivalry among the foremen, each one vieing with the others in turning out the greatest number of feet ballasted. The result, naturally, was very poor and ultimately expensive ballasting.

Two months after the extra gangs had left a section which they had given the standard finish, the foreman of one of these sections was given ten days suspension by record (the Brown System) for raising track out of surface, thereby leaving the track half filled to top of ties and leaving a weak shoulder. He protested and demanded an investigation. When the investigation was made the division engineer and roadmaster found the ties were tamped only on the outside of the rails and gravel had been dumped from center dumps, filling in the center of track loosely. The track was then dressed to the company's standard and in a short time the track became very uneven. The section foreman surfaced portions of this rough track to the high points and gave the track a thorough tamping inside and out, thereby using a large quantity of gravel which caused him to be censured unjustly.

An extra gang was returned to this section to resurface it and was closely watched by the roadmaster. (The ballasting was under the charge of a general foreman who was getting his first track experience.) The entire section was resurfaced and re-dressed to the company's standard, causing the work to cost greatly in excess of what it would have if honest work had been done when the track was first ballasted; on other sections the gangs were increased to pick up the rough spots and re-dress the track. This occurred a dozen years ago but to this day estimates of the cost of ballasting are quite often made from the records made by those foremen at that time.

While a competent extra gang foreman, if not required to turn out an excessive number of feet per man, will turn out an excellent quality of work, I find the average extra gang ballasting still does not hold nearly as well as when done by increased section gangs. The reason for this is that section foremen are drilled in thoroughness. Their whole ambition is to turn out quality as well as quantity, and they will without a doubt sacrifice quantity for quality, which is directly opposite to the methods employed by the average extra gang foreman. While by using enlarged section gangs the cost may be slightly in excess of extra gang work, the ultimate cost will be far less; this has proven itself many times.

In the West it is far easier to obtain and retain extra gang than section laborers. The principal reason is that we are usually furnished Greek labor in extra gangs, and they hire out in parties of from ten to twelve men, all relatives or boyhood friends; they stick together and will not work on sections unless they cannot find extra gang work. They will leave the sections as soon as they can find extra gang work elsewhere.

Section foremen in this part of the West are far more capable of handling ballasting, rail renewing, etc., than the average "floating" foremen; comparison of results has proven this times without number. In renewing rails I would favor the combining of section gangs to relay worn out curves or short stretches of track, but where the whole division is to be relaid I would favor using extra gangs to do the work, selecting the foremen to take charge of these gangs from among the best foremen on the division. The latter would be far better qualified than outside foremen who are not familiar with the usages of the road. The section men will closely watch their work and will take pride in the quality of the work. Being loyal to their employers, they will not leave bad gauge, poor ties at joints, etc., for the section foremen to remedy after they are gone, as is invariably the case with the "floaters" who are merely working for dollars and cents.

Many will object to taking section foremen away to do this special work, basing their objections upon the theory that it would disrupt the section organization.

Their objection is based on theory alone, for every roadmaster has on his district or division several men who act as emergency foremen, taking the place of regular foremen when sick or taking a month's vacation. These men are in line for permanent places as section foremen; they are familiar with the requirements and usages of the road, and they have "made good." I see no reason why they cannot be placed in charge of the sections while the regular foremen are employed on special work.

The city of Temple, Tex., having granted a franchise which will enable the Temple Northwestern & Gulf to enter the city, construction work on the road, which has been at a standstill for some two months, has been resumed. This is one of the most important new lines in the state. When completed it will extend from Thurber, on a short branch of the Texas & Pacific, southward to Temple, 150 miles, insuring needed railroad facilities to a large section of west Texas and opening a new outlet to the Gulf.

The Tampa, Charlotte & East Coast is making surveys for a line from Tampa to east coast of Florida. The contract has been let and work will be started as soon as surveys are completed.

The Wabash is considering building a new line between Hannibal and Moberly, Mo.

Surveys for a main line by Butte, Wisdom & Pacific have been completed and surveys started for branch line. The main line will run from Divide to Jackson, Mont., and branch up Wise River 26 miles to Elkhorn, Mont. Rock work and construction of three tunnels between Divide and Dewey will be started soon. W. R. Allen, Butte, Mont., is president.

Personals

Although we are publishing monthly in these columns a practically complete report of all appointments of interest to our readers, it is probable that this information could be published earlier if each subscriber would make it his business to notify us of new appointments immediately. We request and we shall appreciate your assistance in this respect.

O. T. NELSON, superintendent of maintenance of way of the *Atlanta & West Point R. R.*, has been transferred from Montgomery to Atlanta, Ga.

C. WOODARD, formerly roadmaster, has been promoted to superintendent of rock quarry of the *Atlantic Coast Line R. R.*, at Elm City, N. C. R. R. DEMPSEY has been appointed roadmaster at Tarboro, N. C. J. E. HINES, formerly assistant roadmaster at Tarboro, N. C., has been transferred to second track construction between Rocky Mount and Richmond. W. H. JONES, formerly of the A. & Y. division, has been appointed roadmaster at Wilmington, N. C., succeeding C. B. RIDDICK, who has been appointed roadmaster at Rocky Mount, N. C. Mr. RIDDICK succeeds Mr. WOODARD, promoted.

A. LARSON, roadmaster of the *Canadian Pacific Ry.*, has been transferred from Ignace to Ft. William, Ont. J. QUINLAN has been appointed roadmaster, Manitoba division, office at Ft. William, Ont.

A. BOSLEY has been appointed roadmaster of the *Central Vermont Ry.* at St. Albans, Vt., succeeding M. H. VINCENT.

J. M. FLANAGAN has been appointed roadmaster of the *Charleston & Western Carolina Ry.* at Fairfax, S. C.

O. B. COOK has been appointed roadmaster of the *Chicago & North-Western Ry.* at Mason City, Ia. He succeeds M. MCFADDEN, appointed roadmaster at S. Pekin, Ill.

E. LEAON, formerly roadmaster of the *Chicago Great Western R. R.* at Council Bluffs, Ia., has been appointed roadmaster at St. Paul, Minn., in charge of track from St. Paul to Hayfield, and also four large yards at Minneapolis. He succeeds J. LARSON.

C. FALLON has been appointed roadmaster of the *Chicago, Milwaukee & St. Paul Ry.* at Harlowton, Mont., succeeding H. GRIMES. F. J. NOONAN has been appointed roadmaster at Aberdeen, S. D. N. POSTEL has been appointed roadmaster at Missoula, Mont., succeeding O. MILLER.

CHAS. FLYNN has been appointed roadmaster of the *Chicago, Rock Island & Pacific Ry.* at Des Moines, Ia., succeeding J. SINGLETON, deceased. G. W. KOHN, roadmaster, has been transferred from Peoria to Joliet, Ill., succeeding A. E. MUSCHOTT. D. D. LEHAN has been appointed roadmaster at Peoria, Ill., succeeding MR. KOHN. W. B. MCADAMS has been appointed roadmaster at Haileyville, Okla. He succeeds J. F. WEATHERMAN, appointed roadmaster at Brinkley, Ark., in place of J. A. TRAINOR. E. SULLIVAN has been appointed roadmaster at Washington, Ia., succeeding C. FLYNN, transferred.

L. M. DENNEY, formerly at Galion, O., has been appointed supervisor of track of the *Cleveland, Cincinnati, Chicago & St. Louis Ry.* at Anderson, Ind. H. P. SULLIVAN has been appointed supervisor of track at Galion, O., succeeding Mr. DENNEY.

A. E. MUSCHOTT has been appointed roadmaster of the *Elgin, Joliet & Eastern R. R.* at Joliet, Ill., succeeding R. ROBERTS.

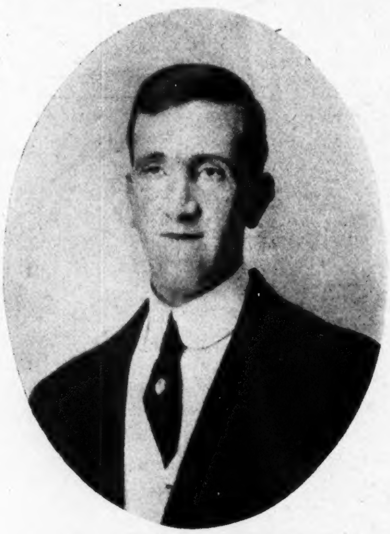
JOHN GOODRIE, formerly assistant roadmaster at Grafton, has been appointed assistant roadmaster of the Dakota division, *Great Northern Ry.*, at Devil's Lake, N. D. C. HARA has been appointed roadmaster at Morris, Minn., succeeding T. RASMUSSEN. EDWARD JOHNSON has been appointed assistant roadmaster at Havre, Mont., succeeding JOHN HAMILTON. L. MCELROY, assistant roadmaster, has been transferred from Great Falls to Judith Gap, Mont. P. NELSON has been appointed assistant roadmaster at Grafton, N. D., succeeding Mr. GOODRIE. JOHN WALLIN has been appointed assistant roadmaster at Great Falls, Mont.

WM. G. ARN has been appointed roadmaster of the *Illinois Central R. R.*, Indiana division, at Mattoon, Ill., succeeding F. B. OREN, appointed roadmaster, St. Louis division, at Carbondale, Ill. Mr. OREN succeeds J. F. PLOTT, resigned. SAM HOLT has been appointed roadmaster at Fulton, Ky., succeeding M. B. MORGAN, promoted. G. H. PEACOCK, supervisor, has been transferred from Water Valley to Grenada, Miss.

G. T. ANDERSON has been appointed roadmaster of the *Kansas City Southern Ry.* at Spiro, Kan. He succeeds D. B. SHRIVER, roadmaster, who has been transferred to the first district, with office at Pittsburg, Kan. FRANK RATCLIFF has been appointed roadmaster at Kansas City, Mo., succeeding P. SLOAN.

G. W. ARNOLD has been appointed roadmaster of the *Minneapolis, St. Paul & Sault Ste. Marie Ry.* at Wahkon, Minn.

W. A. KENNON has been appointed general roadmaster of the *Missouri Pacific Ry.*, Louisiana division, office at Monroe, La. Previous to this appointment he was division engineer of the Illinois division, and general roadmaster of the Memphis division. The headquarters of W. M. BOWERS, roadmaster, have been moved from Huttig to Monroe, La., his territory, however, remaining the same.



J. P. ANDERSON, Roadmaster*
Canadian Pacific Ry.

F. L. GUMM has been appointed roadmaster at Raton, N. M. A. W. HEYER has been appointed roadmaster at Batesville, Ark. A. C. HINCKLEY, formerly roadmaster at Monroe, has been appointed roadmaster of the Vidalia to Collinston district, office at Ferriday, La. He succeeds J. G. MAYNOR, appointed roadmaster of the Felsenthal to Monroe district, office at Monroe, La. J. M. WARREN has been appointed roadmaster at Batesville, Ark. WM. WEILAND has been appointed roadmaster at Coffeyville, Kan., succeeding H. ROBERTS.

G. M. DUGGER has been appointed roadmaster of *Morgan's Louisiana & Texas R. R.* at Lafayette, La., succeeding AUGUST WEHMER, appointed roadmaster at New Iberia, La., vice J. M. KING.

L. C. CASE has been appointed district supervisor of the *New York, Chicago & St. Louis R. R.* at Cleveland, O.. succeeding W. H. ELLIOTT.

E. M. RITON, roadmaster and acting trainmaster of the *Northern Pacific Ry.* at Glendive, Mont., has been transferred to Livingstone, Mont. He succeeds NELS VORDAHL, appointed roadmaster at Laurel, Mont., vice C. C. HOUSTON, appointed roadmaster and acting trainmaster at Glendive, Mont.

GUS BLASER has been appointed roadmaster of the *Oregon Short Line R. R.* at Kemmerer, Wyo., succeeding J. J. DAILY, resigned.

H. W. COOPER has been appointed roadmaster of the *St. Louis & San Francisco R. R.* at Pittsburg, Kan., succeeding D. C. DAVIS.

*Mr. Anderson's appointment was noted in the November issue.

CHARLES FLYNN, Roadmaster
Chicago, Rock Island & Pacific Ry.

A. E. MUSCHOTT, Roadmaster
Elgin, Joliet & Eastern Ry.

J. P. WARREN has been appointed roadmaster of the *St. Louis South Western Ry.* at Pine Bluff, Ark., succeeding J. M. GAUNT.

W. J. BRIDGES, formerly assistant roadmaster, has been appointed roadmaster of the *St. Louis South Western of Texas* at Tyler, Tex., succeeding J. P. WARREN. C. J. FINNELLE has been appointed assistant roadmaster at Hamilton, Tex.

F. W. EASTON has been appointed roadmaster of the *Southern Pacific Co.* at Ogden, Utah. He succeeds J. REDDY, appointed roadmaster of the Wells district, office at Montello, Nev. F. REILLY, formerly roadmaster at Montello, has been appointed roadmaster of the Stockton division at Merced, Cal., succeeding P. FERGUSON. B. ROLAND, formerly roadmaster at Tracy, has been appointed roadmaster of the Suisun district at Suisun, Cal., succeeding O. Thayer. The Mt. Diablo roadmaster's district, headquarters, Tracy, Cal., has been abolished.

C. J. HARRINGTON, formerly supervisor at Greenville, has been appointed supervisor of the *Yazoo & Mississippi Valley R. R.* at Rolling Fork, Miss. A. S. LATHAM has been appointed supervisor at Memphis, Tenn.

M. BARRETT has been appointed supervisor of the *Tennessee Central Ry.* at Nashville, Tenn., succeeding J. J. PRINCE.

WALTER E. EMERY of Peoria, Ill., for the past five years chief engineer of the Peoria & Pekin Union Ry., has been named by the Illinois State Highway Commission to be the first county superintendent of highways for Peoria Co., Illinois. His appointment has been made in compliance with the terms of the recently enacted Tice Good Roads Law. Four candidates took the Civil Service examination for Peoria County. Three of the candidates failed, Mr. EMERY being the only one to successfully pass the examination. Mr. EMERY was for a short while engineer of maintenance of the Western division of the Chicago & Alton Ry., and before that for a long term of years was a roadmaster on the Chicago & North-Western Ry.

With The Manufacturers

NATIONAL ASSOCIATION OF PURCHASING AGENTS.

On October 16 the National Association of Purchasing Agents was organized, with headquarters in New York.

Over 100 purchasing agents and buyers representing some of the largest industrial corporations, railroads, steamship lines, street railways, gas and electric companies in New York, New Jersey and Connecticut are now members, and there are several hundred others who have signified their intention of becoming members.

H. T. Leeming, of Thos. A. Edison, Inc., was elected temporary chairman, and Elwood B. Hendricks, the organizer of this association, was elected temporary secretary and treasurer, with temporary headquarters at Hotel McAlpin, 34th street and Broadway, New York city.

This association will be devoted entirely to the interests of purchasing agents and buyers, and will have sub-associations in all sections of the country. Some of the objects are: (1) the formation of the purchasing agents and buyers into a national body; (2) mutual acquaintance and the resulting privilege of exchanging ideas and opinions; (3) the standardization of purchasing routine and methods; (4) the investigation and certification of new appliances and materials; (5) the improvement of existing methods for the diffusion of market information; (6) the gathering and dissemination of data relating to the subject of buying; (7) the standardization of specifications, and other features that will probably be suggested in the future that will be of benefit or interest to the purchasing agent or buyer.

TEST OF FIREPROOF PAINTS.

Editor, *Railway Engineering:* I have read in your November issue a report by the committee on fire-resisting coatings for timbers, rendered at the annual American Railway B. & B. Association at Montreal, and venture a criticism.

In the first place, I cannot understand why only ten paints were tested, when to my personal knowledge there were at least twenty-one sent by as many manufacturers for the purpose. It seems to me that perfect fairness would have required that all the paints sent for the purpose should have had the privilege of the test, or that none should have had it.

Another and a very serious criticism I wish to make is of that portion of the report based upon the conclusion of the committee "that there is no coating on the market that is absolutely fireproof."

In September, 1912, the Gorman Paint Co. received a letter from the general bridge inspector of a prominent railroad, explaining that he was preparing a test of fire-resisting liquids for a committee report, and suggesting that if we had a fire-proof liquid coating which was considered applicable to railroad bridges, to donate enough to cover a space which he designated, and he

would be glad to make a test of it. Immediately I sent the required amount of Wing's fire-proof paint. A little later in the month I received his acknowledgement of receipt of paint as follows:

"I wish to acknowledge receipt of some of your fire-resisting paint for the purpose of making a test. I thank you for your co-operation. The fire tests will be applied next summer and I will let you know the exact date."

When in Chicago on other business during the winter, after having sent the paint in September, I made a point of inquiring about the progress of preparation for the forthcoming test, and it was at that time that I learned (not from the general bridge inspector, however) of the number of paints that had been received and applied to timbers in readiness for said test, and as stated above there were at least twenty-one of them, mine among the number.

On May 30, 1913, I inquired by letter of the general bridge inspector in question, as to about when the test might be expected to come off. I have his reply to the effect that he did not know when it would take place. This reply was dated June 1, 1913, and the statement embodied in general report of the Montreal meeting of the B. & B. Association, as published in November issue of *Railway Engineering*, states that the test took place on June 28, 1913.

Now, it is not my purpose to criticise the general bridge inspector individually. But the thing that is not clear to me is this: If he did not know when the test was to take place—*why* didn't he? Since he was presumably in charge of the arrangements for test, why wouldn't he not only have known when it was to have taken place, but why wouldn't he have kept his word with reference to notifying me as one of those who sent paint for the test upon his invitation? On the other hand, if for any reason the matter had been taken from his control, why did not his successor carry out the plans that seem to have been first made?

And what was the object, anyhow, of inviting a score or more firms to send samples, if only a selected ten were to have been given a chance to compete? And why were there, among those not tried out, a paint that has stood the most severe tests in private and public trials—tests that have secured and held some of the best railroad business in the country? How could it have been excluded, unless intentionally, when it was applied to timbers on the test grounds and was in plain sight on said premises?

I don't know how the other discarded manufacturers feel about this thing, but as for me, I have a great big kick coming. And the thing that I am most put out about is the report rendered from this imperfect test to the effect that there is "no fire-proof coating on the market." It reminds me of the native who disclaimed the idea that feathers were soft. He had slept on one a whole night, carefully placed upon his stone bed, and he knew, therefore, by actual test, that feathers were not soft.

I am compelled, individually, to conclude that the test was, to say the least, very indifferently conducted, and since I must be one of the sufferers from the ultimatum, that there is no such thing as fire-proof paint—unless I can undo the harm done—I wish to invite all who are in doubt to let me prove to them that there is a paint which absolutely withstands fire; that will turn flames hot enough to make red-hot such metals as tin, sheet iron, etc., and that it is a most perfect protection to buildings, bridges, and all wooden structures. The chemical that makes it so was discovered thirty years ago by the writer and since that date has been used exclusively in the Wing products.

The sample I sent for this test was a dark red linseed oil paint, ready for the brush. (You will note that the test mentions no such paint.) There was no heating necessary—no complication of coatings and no special instructions. The only requirement is that the paint must be well stirred before applying. The quality of the product does the rest, and the fire-resisting element increases with time.

And, now, if you will publish this kick from one who resents being left out of it in any such fashion as herein described, perhaps it may at least help to avoid slipshod methods for tests in the future—whether willfull or otherwise.

(Signed) T. G. WING.

The Selling Side

The Edison Storage Battery Company, Orange, N. J., has nearly completed its new Orange plant. New machinery will be received by the latter part of December, and an addition of nearly 2,000 employees will be made.

The Philip Carey Co. have been awarded contract for roofing the warming and service building at the new Michigan Central terminal, and also all of the pipe covering in tunnels from Fourteenth to Twentieth street, Detroit, Mich.

The Canadian H. W. Johns-Manville Co., Limited, has moved its Toronto branch to No. 19 Front street, East, where it will have a floor area of approximately 35,000 square feet. It is situated in the heart of the wholesale district.

"Mr. O. DeG. Vanderbilt, Jr., president of the Weir Frog Co., after an absence of several months in the East, has again returned to Cincinnati permanently for the winter. He has personally supervised the many changes which the Weir Frog Co. has made in its shop and methods of handling its business; this is being done with a view to increased service and equipping the plant to take care of a greatly increased volume of business with the use of heavier rail and improved constructions which the railroads have found necessary in the last few years."

The division of valuation of the Interstate Commerce Commission for the central district has been located at the Karpen building, 910 S. Michigan Ave., Chicago, a contract having just been closed by the government for about 6,000 square feet of space in this building. This is the headquarters for one of the five districts into which the country has been divided for the valuation of railroad properties. The above office is located on the ninth floor, facing on Eldridge court, and is in charge of W. D. Pence, who is at present located in room 900, until the force is increased to its full strength, which will probably take a month or two. The Boiler Makers' Inspection department of the Interstate Commerce Commission is also located in this building, as well as the Railway Supply Permanent Exhibit and the offices of the Master Mechanics' Association, the Master Car Builders' Association, the Western Railway Club and the American Railway Engineering Association.

BOOK REVIEW.

How to Write Advertisements That Sell. 4½ x 7 inches. 128 pages, 20 illustrations. Published by A. W. Shaw Co., Chicago.

This book is a very clear exposition of the elementary features to be considered in writing advertising copy. There are five parts, as follows: (1) How to plan and prepare; (2) Novel ways to reinforce your copy; (3) How to write the advertisement and make the layout; (4) Planning out mediums, space and appropriations; (5) Raising your average of returns.

Under the different headings, as outlined, a quantity of information is given, which is of interest to the advertiser.

A small but suggestive table is given showing a way of analyzing the advertising problem, and this elementary table is considered to be the foundation of successful advertising.

The book is written on a comprehensive basis so that the information is adaptable to practically every business.

The latter part of the book discusses advertising copy, treating different parts separately and the advertisement as a whole. There is also contained in the book much correlated matter which is often neglected in advertising, all of which, however, is considered important in the development of successful advertising.

WRENCH IDEALS

WHEN COES Wrenches were first placed on the market in 1841 a wrench ideal possessed the minds of its makers and designers.

Modern requirements have modified this ideal, but the present design of COES Wrench—the COES you get when you ask for it—comes as near the realization of the ideal as anything made by human hands.

THE ideal combination is a COES Wrench in the sturdy hand of a good workman.

Here you have the ideal in the practical—the practical in the ideal.

The wrench ideal in the discriminating workman's mind, is a COES Wrench, and we are sparing neither pains nor expense to preserve it.

COES WRENCH CO.
WORCESTER, MASS.

CLASSIFIED INDEX OF ADVERTISERS

CLASSIFIED INDEX—Continued.

Rail Benders.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Rail Braces.
Atlas Railway Supply Co., Chicago.
Cincinnati Frog & Switch Co., Cincinnati, O.
Indianapolis Switch & Frog Co., Springfield, O.
Weir Frog Co., Cincinnati.

Rail Drills.
Indianapolis Switch & Frog Co., Springfield, O.

Rail Joints.
Atlas Railway Supply Co., Chicago.
International Interlocking Rail Joint Co., Chicago.
Rail Joint Co., New York City.
Weir Frog Co., Cincinnati, O.

Railway Equipment and Supplies.
American Valve & Meter Co., Cincinnati, O.
Atlas Railway Supply Co., Chicago.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Industrial Supply & Equipment Co., Philadelphia, Pa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Rail Joint Co., New York.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati.

Replacers, Car and Engine.
Johnson Wrecking Frog Co., Cleveland, O.

Right-of-Way Gates.
Iowa Gate Co., Cedar Falls, Ia.

Roofing Materials, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Rotary Pumps.
Blackmer Rotary Pump, Power & Mfg. Co., Petoskey, Mich.

Roundhouse Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Screw Spikes.
Hart Steel Co., Elyria, O.

Section Cars, Gasoline.
Chicago Pneumatic Tool Co., Chicago.
Fairmont Machine Co., Fairmont, Minn.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Sheathing, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Sheet Metal.
Gray, Peter, & Sons, Boston.

Shingles, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Shovel Handles.
Wyoming Shovel Wks., Wyoming, Pa.

Shovels, Spades and Scoops.
Hubbard & Co., Pittsburg, Pa.
Wyoming Shovel Wks., Wyoming, Pa.

Signal Lamps.
Gray, Peter, & Sons, Boston.

Signs.
Stonehouse Enameled Steel Co., Denver, Colo.

Smoke Jacks, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Spark Coils.
Edison, Thos. A., Inc., Orange, N. J.

Spikes.
Hart Steel Co., Elyria, O.

Steam Shovels.
Bucyrus Co., S. Milwaukee, Wis.

Steel Bumping Posts.
Railway & Traction Supply Co., Chicago.

Steel Gates.
Iowa Gate Co., Cedar Falls, Ia.

Steel Plate Work.
Chicago Bridge & Iron Works, Chicago.

Steel, Structural.
Chicago Bridge & Iron Works, Chicago.

Storage Batteries.
U. S. Light & Heating Co., New York.

Striking Hammers.
Hubbard & Co., Pittsburg, Pa.

Switch Lanterns.
Gray, Peter, & Sons, Boston.

Switch Rods.
Weir Frog Co., Cincinnati, O.
Ramapo Iron Works, Hillburn, N. Y.

Switches and Switch Stands.
American Valve & Meter Co., Cincinnati, O.
Atlas Railway Supply Co., Chicago.
Cincinnati Frog & Switch Co., Cincinnati.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati.

Switchboard Adjusters.
Weir Frog Co., Cincinnati.

Tanks and Tank Fixtures.
Bowser, S. F., & Co., Ft. Wayne, Ind.
Chicago Bridge & Iron Works, Chicago.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Telegraph and Telephone Supplies.
Central Electric Co., Chicago.
Hubbard & Co., Pittsburg.

Tie Plates.
Atlas Railway Supply Co., Chicago.
Hart Steel Co., Elyria, O.

Ties, Concrete.
Sisk Universal Concrete Tie Co., San Francisco, Cal.

Ties, Steel.
Universal Metallic Tie Co., Salt Lake City, Utah.

Track Drills.
National Standard Co., Kalamazoo, Mich.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Jacks.
National Standard Co., Kalamazoo, Mich.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Laying Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Materials.
Atlas Railway Supply Co., Chicago.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Verona Tool Works, Pittsburg, Pa.
Weir Frog Co., Cincinnati.

Track Tools.
National Standard Co., Kalamazoo, Mich.
Hubbard & Co., Pittsburg, Pa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Verona Tool Works, Pittsburg, Pa.
Wyoming Shovel Works, Wyoming, Pa.

Transfer Tables.
Nichols, Geo. P., & Bro., Chicago.

Trolley Brackets.
Electric Ry. & Equip. Co., Cincinnati, O.

Turntable Tractors.
Nichols, Geo. P., & Bro., Chicago.

Turntables.
Chicago Bridge & Iron Works, Chicago.
Nichols, Geo. P., & Bro., Chicago.

Valve Grease, Graphite.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Velocipede Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Ventilating System.
Gale Installation Co., Chicago.

Washers.
Hubbard & Co., Pittsburg, Pa.

Water Columns.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Water Coolers.
Gray, Peter, & Sons, Boston.

Water Filters.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

Waterproofing.
M. J. Egleston, Chicago, Ill.

Water Softeners.
Booth, L. M., Co., New York, N. Y.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

Wedges.
Hubbard & Co., Pittsburg, Pa.

Wheelbarrows.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

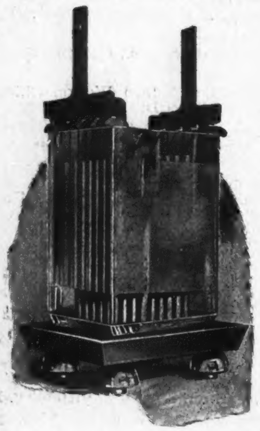
Wires.
Central Electric Co., Chicago.

Wire Tapes and Cords.
Central Electric Co., Chicago.

Wrecking Frogs.
Johnson Wrecking Frog Co., Cleveland, O.

Wrenches.
Coe's Wrench Co., Worcester, Mass.

Zincs.
Edison, Thos. A., Inc., Orange, N. J.



Alphabetical Index to Advertisers